BANGLADESH WATER DEVELOPMENT BOARD

Project Completion Report: IMED 04/2003(Revised)

Name of the Project	:	Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River system) Project (2nd Revised)
Implementation Period	:	April, 2010 to June, 2022

October 2022

Government of the People's Republic of Bangladesh
Ministry of Planning
Implementation Monitoring and Evaluation Division

PROJECT COMPLETION REPORT: IMED 04/2003 (Revised)

A. PROJECT DESCRIPTION:

01. Name of the Project : Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River system) Project (2nd Revised)

02. Administrative Ministry/Division : Ministry of Water Resources (MoWR).

03. Executing Agency : Bangladesh Water Development Board (BWDB).

04. Location of the Project :

Division	District	Upazila
Dhaka	Dhaka	Savar, Pallabi, Mohammadpur, Mirpur, Karanigonj.
	Gazipur	Gazipur sadar, Kaliakoir.
	Tangail	Kalihati, Tangail sadar, Basail, Mirzapur.

05. Objectives of the Project :

- Improvement of water quality through enhancement of dry season flow in the Buriganga & Turag River system.
- To ensure adequate draft in the Buriganga & Turag River system so that river crafts may ply round the year.
- Irrigation and fisheries development.
- Improvement of overall economic, social & environmental condition.
- Control of unauthorized encroachment control along Buriganga River.

06. Estimated Cost:

(In lakh Taka)

	Original	1st Revised	Latest Revised (2nd)
(a) Total	94409.07	112559.33	112559.33
(b) Taka	94409.07	112559.33	112559.33
(c) Foreign Currency	-	-	-
(d) Project Aid	-	-	-
(e) RPA	-	-	-

07. Date of Approval	:	PCP	PP
(a) Original	:	-	06/04/2010
(b) No Cost Time Extension (1st)	:	-	12/02/2014
(c) No Cost Time Extension (2nd)	:	-	05/03/2015
(d) 1st Revised	:	-	14/06/2016
(e) Latest Revised (2nd)	:	-	24/07/2019
(f) No Cost Time Extension (3rd)	:	-	23/06/2021
(g) Inter Item Cost Adjustment	:	-	17/01/2022

08. Implementation Period :

	Date of Commencement	Date of Completion
(a) Original	April,2010	December, 2013
(b) No Cost Time Extension (1st)	April,2010	December, 2014
(c) No Cost Time Extension (2nd)	April,2010	December, 2015
(d) 1st Revised	April,2010	June, 2020
(e) Latest Revised (2nd)	April,2010	June, 2021
(f) No Cost Time Extension (3rd)	April,2010	June, 2022
(g) Actual	April,2010	June, 2022

09. Financing Arrangement (Source-wise):

9.1 Status of Loan/Grant

a) Foreign Financing: Not Applicable

Source (s)	Currency as per Agreement	Amount in US $ (Million)	Nature (Loan/Grant/ supplier's/ credit)	Date of Agreement	Date of Effective-ness	Date of Closing	
						Original	Revised
1	2	3	4	5	6	7	8
----------N/A----------							

b) GOB:

(In lakh Taka)

Total amount	Loan	Grant	Cash Foreign Exchange
1	2	3	4
112559.33	-	112559.33	-

9.2 Utilization of Project Aid: (Source wise) Not Applicable

(In million)

Source (s)	Total Amount		Actual Expenditure		Unutilized Amount	
	In US $	In Local Currency	In US $	In Local Currency	In US $	In Local Currency
1	2	3	4	5	6	7
----------N/A----------						

9.3 Reimbursable Project Aid (RPA) : Not Applicable

(In lakh Taka)

RPA Amount		Amount Spent	Amount Claimed	Amount Re-imbursed	Remarks
As per PP	As per Agreement				
1	*2*	*3*	*4*	*5*	*6*
----------N/A----------					

B. IMPLEMENTATION POSITION

01. Implementation Period:

Implementation Period as per DPP		Actual Implementation period	Time Over-run (% of original implementation period)	Remarks
Original	Latest Revised			
1	*2*	*3*	*4*	*5*
April, 2010 to December, 2013 (3 years 9 months)	April, 2010 to June, 2022 (12 years 3 months)	April, 2010 to June, 2022 (12 years 3 months)	226.67% (8 years 6 months)	The project was prepared based on a study conducted in 2004. After approval of the project in 2010, few setbacks were observed during implementation. The major setbacks being quick siltation in the intake water route and other being possibility of endangering foundation of existing bridges in the augmented route. To find a solution both mathematical & physical modelling were run. After analyzing the findings by national experts, some changes in project planning & design were bought in. To accommodate that 1st RDPP was approved in 2016 with the project period lasting 2020. Later the project was extended for 2 more years for re-arranging financial provision of land acquisition & guide bundh expenditures. Overall covid-19 situation played a role for time-oven run also.

02. Cost of the Project:

(In lakh Taka)

Description	Estimated Cost		Actual expenditure	Cost over-run (% of original cost)	Remarks
	Original	Latest revised			
1	*2*	*3*	*4*	*5*	*6*
TOTAL	94409.07	112559.33	89246.40	-5.47%	Due to the decrease in dredging work volume as per the post-work survey, the Cost of the whole project decreased by 5.47%.
TAKA	94409.07	112559.33	89246.40	-5.47%	
PA	-	-	-	-	

03. Project Personnel:

Sanctioned strength as per DPP	Manpower employed during execution	Status of the existing manpower			Manpower Employed	
		Manpower requirement for O & M as per DPP	Existing manpower for O & M	Others		
1	*2*	*3*	*4*	*5*	*Male*	*Female*
Officer (s) 38 Staff (s) 129 **Total: 167**	The Project had been implemented by the existing manpower of BWDB (Project Management Office, Dhaka O&M Division -2, BWDB, Dhaka, Narsingdi O&M Division, BWDB, Narsingdi & Tangail O&M Division, BWDB, Tangail.) No new/extra manpower had been appointed for the implementation of the project.					

04. Training of Project Personnel (Foreign/Local): No training programme was included in the DPP of the project.

Field of Training /Study tour /workshop /Seminar etc.	Provision as per DPP		Actual		Remarks
	Number of persons	Man - months	Number of persons	Man -months	
1	2	3	4	5	6
a. Foreign	----------N/A----------				
b. Local	----------N/A----------				

05. Component-wise Progress (As per latest Approved DPP):

(In lakh Taka)

Items of work (As per DPP)	Unit	Target (as per RDPP)		Actual Progress		Reasons for deviation (±)
		Financial	Physical (Quantity)	Financial	Physical (Quantity)	
1	2	3	4	5	6	7
A. Revenue						
Supplies and Services						
a) PMO Maintenance	L. S.	71.50	1 item	56.24	1 item	
b) Survey & investigation	L. S.	82.00	1 item	60.58	1 item	
c) Consultancy services (Mathematical & physical modeling)	L. S.	300.00	1 item	274.82	1 item	
Repair & Maintenance						
Motor Vehicle, Furniture's & Fixtures, Machineries & Equipment etc repairs & maintenance works for PMO & Field offices	L. S.	33.00	1 item	27.79	1 item	
Sub-Total (Revenue) =		**486.50**	-	**419.43**	-	
B. Capital						
Acquisition of Assets.						
Motor Vehicles						
A. Jeep	Nos.	50.00	1	50.00	1	
B. Motorcycle	Nos.	4.72	4	4.72	4	
C. Multimedia/Projector machine	set.	1.92	1	1.92	1	
Computer & Accessories						
A. Computers (PC)	Nos.	1.50	3	1.50	3	
Computers (Laptop)	Nos.	0.92	1	0.92	1	
B. Printers.	Nos.	0.90	3	0.90	3	
C. UPS. (1000VA)	Nos.	0.24	3	0.24	3	
Computer software	L. S.	0.11	1 item (full)	0.11	1 item (full)	
Office Equipment						
A. Photocopier	Nos.	2.42	2	2.42	2	
B. Fax machine	Nos.	0.30	1	0.30	1	
C. Calculator	Nos.	0.10	10	0.10	10	
Furniture & fixture	L. S.	5.00	1 item (Full)	5.00	1 item (Full)	
Acquisition of land						
For Sediment Basin & Guide Bundh-85.00 hac.	hectare	26900.00	85.00	25097.13	83.48	83.48 hac. Land acquisition completed as per actual

Items of work (As per DPP)	Unit	Target (as per RDPP)		Actual Progress		Reasons for deviation (±)
		Financial	Physical (Quantity)	Financial	Physical (Quantity)	
1	2	3	4	5	6	7
						requirements.
Construction of Civil works						
Construction of Guide bund	km.	28376.04	1.53	26970.37	1.53	Lesser expenditure incurred due to savings in the tender process.
River Dredging Work						
By Manual Labor/Excavator	km.	9007.23	55.91 km	9007.23	55.91 km	
By Dredger	km	20316.60	80.25 km	9605.55	80.25 km	
Construction of Sediment Basin.	lakh cum	1595.04	43.40	1385.27	27.47	Post work measurement was not taken just after completion of work. It was taken few months later. In the meantime, severe siltation occurred in the basin. So, in joint survey, lesser volume of work was measured.
Protective Works for Sediment	km	3054.64	1.50	2744.38	1.50	Lesser expenditure incurred due to reduced slope length.
Foundation Treatment of Bridges	nos	5443.29	19	1362.08	8	Foundation treatment works is included in 19 bridges under the project. There are 9 bridges of LGED, 8 bridges of RHD and 2 bridges of Bangladesh Railway. Among these, foundation treatment works of 6 bridges of LGED, 1 bridge of RHD and 1 bridge of Bangladesh Railway have been implemented as per actual requirements after consultation with concern agencies. According to discussion on inter-ministerial meeting held on 08-11-2021, foundation treatment of 3 LGED bridge and 1 Railway bridge was not required. For 7 RHD bridge, the cutting depth was very close to the rivers existing bed level on bridge locations. So according to BWDB's design wings opinion, those bridges weren't carried out.
Operation & Maintenance dredging for Rivers.	Km	14503.83	54.50	11803.42	54.50	
Operation & Maintenance of dredging for Sediment Basin	lakh cum	2808.03	36.47	783.41	10.31	Post work measurement was not taken just after completion of work. It was taken few months later. In the meantime, severe siltation occurred in the basin. So, in joint survey, lesser volume of work was measured
Sub-Total (Capital) =		**112072.83**	-	**88826.97**	-	
Total (Revenue + Capital) =		**112559.33**	**100%**	**89246.40**	**94.89%**	

06. Information regarding Project Director (s):

Name & Designation with pay Scale.	Full time	Part time	Responsible for more than one project	Date of		Remarks
				Joining	Transfer	
1	*2*	*3*	*4*	*5*	*6*	*7*
Md. Humayun Kabir Chief Engineer Pay Scale: 2nd Grade BDT 33500- 39500/-	Yes	-	Yes	29 June, 2010	15 November, 2010	
Sunil Baran Debroy Chief Engineer Pay Scale: 2nd Grade BDT 33500- 39500/-	Yes	-	Yes	15 November, 2010	10 March, 2013	
Md. Mahtab Uddin Chief Engineer Pay Scale: 2nd Grade BDT 33500- 39500/-	Yes	-	Yes	10 March, 2013	02 June, 2013	
Md. Amanullah Addl Chief Engineer Pay Scale: 3rd Grade BDT 29000-33600/-	Yes	-	Yes	02 June, 2013	15 January, 2014	
Md. Mahtab Uddin Chief Engineer Pay Scale: 2nd Grade BDT 33500- 39500/-	Yes	-	Yes	15 January, 2014	20 November, 2014	
Md. Ismail Hossain Chief Engineer Pay Scale: 2nd Grade BDT 33500- 39500/-	Yes	-	Yes	20 November, 2014	11 February, 2015	
Md. Belayet Hossain Addl Chief Engineer Pay Scale: 3rd Grade BDT 29000-33600/-	Yes	-	Yes	10 March, 2015	13 July, 2015	
Abul Kalam Azad Chief Engineer Pay Scale: 2nd Grade BDT 66000- 76490/-	Yes	-	Yes	17 August, 2015	17 January, 2017	
A. H. M. Fakhrul Islam Chief Engineer Pay Scale: 2nd Grade BDT 66000- 76490/-	Yes	-	Yes	23 February, 2017	30 October, 2018	
Mohammad Mokibur Rahman Addl Chief Engineer Pay Scale: 3rd Grade BDT 56500-74400/-	-	Yes	Yes	30 October, 2018	03 January, 2019	
Fazlur Rashid Addl Chief Engineer Pay Scale: 3rd Grade BDT 56500-74400/-	-	Yes	Yes	03 January, 2019	14 January, 2019	
Akhil Kumar Biswas Addl Chief Engineer Pay Scale: 3rd Grade BDT 56500-74400/-	-	Yes	Yes	14 January, 2019	23 January, 2019	
Md. Syedul Islam Khan Executive Engineer Pay Scale: 5th Grade BDT 43000-69850/-	Yes	-	-	23 January, 2019	27 June, 2019	
Akhil Kumar Biswas Addl Chief Engineer Pay Scale: 3rd Grade BDT 56500-74400/-	Yes	-	Yes	27, June, 2019	19 May, 2020	
Md. Abdul Matin Sarkar Chief Engineer Pay Scale: 2nd Grade	Yes	-	Yes	16 July, 2020	till to date	

Name & Designation with pay Scale.	Full time	Part time	Responsible for more than one project	Date of		Remarks
				Joining	Transfer	
1	2	3	4	5	6	7
BDT 66000- 76490/-						

07. Procurement of Transport (in Nos.):

Type of transport	Number as per D. P.P.	Procured with date	Transferred to Transport Pool with date	Transferred to O & M with date	Condemned/ damaged with date	Remarks
1	2	3	4	5	6	7
Jeep	1nos.	25-05-2011	-	Ministry of Water Resources, Date: 02-03-2016	-	Vehicle No-Chotto-Metro-ga-11-1699
Motorcycle	4 nos.	30-06-2011	-	03 Nos, Tangail O&M Division, Date:19-07-2011 and 01 no. Dhaka O&M Division, Date: 13-07-2011	-	Vehicle No-Tangail -Metro -H-9242, Tangail -Metro -H-9243, Tangail -Metro -H-9244 and Dhaka-Metro-H-41-5845

08. Procurement of Goods, Works and Consultancy Services:

08.1 a) Works of the Project costing above Tk. 200.00 lakh:

Description of procurement (works) as per bid document	Tender Cost (in crore Taka)		Tender		Date of completion of works	
	As per RDPP	Contracted value	Invitation date	Contract signing	As per contract	Actual
1	2	3	4	5	6	7
1. Excvation of Pungli River from Km. 8.000 to 10.800 = 2.800 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W1-BRRP-REML-1 /2010-2011.	2.25	2.25	09-05-11	10-01-12	30-06-12	30-06-14
2. Excvation of Pungli River from Km. 10.800 to 13.800 = 3.00 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W2-BRRP-REML2/2010-2011	4.26	4.26	26-09-13	04-12-13	30-03-14	25-04-14
3. Excvation of Pungli River from Km. 13.800 to 16.900 = 3.100 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W3-BRRP-REML3/2010-2011	4.26	4.26	09-05-11	08-01-12	30-11-12	30-06-14
4. Excvation of Pungli River from Km. 16.900 to 20.200 = 3.300 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W4-BRRP-REML4/2010-2011	6.23	6.23	26-09-13	04-12-13	30-04-14	30-06-14
5. Excvation of Pungli River from Km. 20.200 to 23.600 = 3.400 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division.Package No. W5-BRRP-REML5/2010-2011	6.69	6.69	09-05-11	08-01-12	30-11-12	31-05-14
6. Excvation of Pungli River from Km. 23.600 to 27.700 = 4.100 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD	7.96	7.96	24-04-11	08-01-12	30-06-12	30-06-13

Description of procurement (works) as per bid document	Tender Cost (in crore Taka)		Tender		Date of completion of works	
	As per RDPP	Contracted value	Invitation date	Contract signing	As per contract	Actual
1	2	3	4	5	6	7
Division. Package No. W6-BRRP-REML6/2010-2011.						
7. Excvation of Pungli River from Km. 27.700 to 32.300 = 4.600 in U.Z 5.Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W7-BRRP-REML7/2010-2011.	8.91	8.91	24-04-11	10-01-12	30-06-12	30-06-13
8. Excvation of Pungli River from Km. 32.300 to 37.400 = 5.100 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W8-BRRP-REML8/2010-2011.	5.64	5.64	26-09-13	05-12-13	30-04-14	30-06-14
9. Excvation of Pungli River from Km. 37.400 to 42.500 = 5.100 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W9-BRRP-REML9/2010-2011.	9.28	9.28	24-04-11	08-01-12	30-06-12	30-06-13
10. Excvation of Pungli River from Km. 42.500 to 48.300 = 5.800 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W10-BRRP-REML10/2010-2011.	7.79	7.79	24-04-11	08-01-12	30-06-12	30-06-13
11. Excvation of Pungli River from Km. 48.300 to 52.600 = 4.300 in U.Z Tangail Sadar Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W11-BRRP-REML11/2010-2011.	5.95	5.95	24-07-11	09-04-12	30-11-12	30-06-13
12. Excvation of Pungli River from Km. 52.600 to 57.800 = 5.200 in U.Z Basail & Mirjapur Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W12-BRRP-REML12/2010-2011.	7.57	7.57	24-07-11	05-04-12	30-11-12	30-06-13
13. Excvation of Pungli River from Km. 2.450 to 5.200 = 2.750 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W14-BRRP-REML14/2011-2012	7.60	7.60	05-05-14	08-07-14	18-12-14	30-06-15
14Excvation of Pungli River from Km. 48.300 to 52.600 = 4.300 in U.Z Kalihati Dist. Tangail in connection with BRRP under Tangail WD Division. Package No. W15-BRRP-REML15/2011-2012	5.68	5.68	26-09-13	04-12-13	30-04-14	25-05-14
15. Dredging of Turag River by Dredger from Km 128.200 to Km 130.850 = 2.65 km. i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Dhaka O&M Division, BWDB, during the year 2018-2019. Package No-BRRP-RED-DDII /P-05/Lot-2/19-20	7.36	2.92	02-02-21	02-02-21	30-06-2022	30-06-22

Description of procurement (works) as per bid document	Tender Cost (in crore Taka)		Tender		Date of completion of works	
	As per RDPP	Contracted value	Invitation date	Contract signing	As per contract	Actual
1	*2*	*3*	*4*	*5*	*6*	*7*
16. Dredging of Turag River by Dredger from km 130.850 to km 132.300 =1.45 Km i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Dhaka O&M Division, BWDB, during the year 2017-2018. Package No-BRRP-RED-DDII /P-05/Lot-2/17-18	6.07	4.42	15-01-18	21-01-18 (MoU)	30-06-22	30-06-22
17. Dredging of Turag River by Dredger from km 132.300 to km 134.100 = 1.80 Km i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Dhaka O&M Division, BWDB, during the year 2017-2018. Package No-BRRP-RED-DDII /P-05/Lot-2/17-18	8.74	5.54	30-07-17	07-08-17 (MoU)	03-06-22	30-06-22
18. Dredging of Turag River by Dredger from Km 134.100 to Km 138.550 = 4.45 km. i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Narsingdi O&M Division, BWDB, Narsingdi during the year 2017-2018. Package No-BRRP-REDP/D-3	21.16	21.15	21-06-15	16-09-15 (MoU)	30-04-21	30-04-21
19. Dredging of Turag River by cutter Suction Dredger and spoil management from km 138.55 to km 142.00 = 3.45 Km i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Dhakai O&M Division, BWDB, Package No-BRPO/Lot-01	9.35	9.35	30-09-10	15-02-11	19-07-11	29-02-12
20. Dredging of Turag River by cutter Suction Dredger and spoil management from km 142.00 to km 145.500 = 3.50 Km i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Dhakai O&M Division, BWDB, during the year 2019-2020. Package No-BRPO/Lot-02	9.60	9.60	08-02-11	13-07-11	28-02-12	31-08-12
21. Dredging of Turag River by Dredger from km 87.500 to km 102.500 Total 15.000Km i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Narsingdi O&M Division, BWDB, Narsingdi during the year 2017-2018. Tender ID No-126003 & Package No-BRRP-RED-ND/P-03/18-19	36.65	33.47	24-10-17	26-02-18	30-06-22	30-06-22

Description of procurement (works) as per bid document	Tender Cost (in crore Taka)		Tender		Date of completion of works	
	As per RDPP	Contracted value	Invitation date	Contract signing	As per contract	Actual
1	*2*	*3*	*4*	*5*	*6*	*7*
22. Dredging of Turag River by Dredger from km 102.500 to km 110.000 =7.500Km i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Narsingdi O&M Division, BWDB, Narsingdi during the year 2019-2020. Tender ID No-370923 & Package No-BRRP-RED-ND/P-04/18-19	26.00	25.73	21-10-19	15-03-20	30-06-22	30-06-22
23. Dredging of Turag River by Dredger from km 110.000 to km 117.500 = 7.500 Km i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Narsingdi O&M Division, BWDB, Narsingdi during the year 2019-2020. Tender ID No-360471 & Package No-BRRP-RED-ND/P-05/18-19	26.00	17.94	16-09-19	24-12-19	28-06-22	28-06-22
24. Dredging of Turag River by Dredger from Km 123.100 to Km 125.100 = 2.00 km. i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Narsingdi O&M Division, BWDB, Narsingdi during the year 2017-2018. Package No-BRRP-RED-ND/P-06/17-18	6.50	5.52	28-06-18	01-10-19 (MoU)	30-04-21	30-04-21
25. Dredging of Turag River by Dredger from km 117.500 to km 123.100 and km 125.100 to km 128.200 Total 8.700 Km i/c with "Buriganga River Restoration (New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System) Project (2nd Revised)" under Narsingdi O&M Division, BWDB, Narsingdi during the year 2019-2020. Tender ID No-360519 & Package No-BRRP-RED-ND/P-07/18-19	29.00	23.78	16-09-19	24-12-19	28-06-22	28-06-22
26. River Dredging by Dredger from Km. 67.000 to Km 87.500 total = 20500m in Upazila - Basail & Mirjapur, District - Tangail in connection with Buriganga River Restoration Project under Tangail O&M Division ,BWDB, Tangail during the year 2017-2018.	15.06	15.06	25-07-16	10-10-16	30-06-18	30-06-22
27. Construction of Sediment Basina at New Dhaleswari offtake Channel in connection with Buriganga River Restoration project under Tangail O&M Division, BWDB, Tangail during the year 2017-2018.	15.95	15.95	25-07-16	10-10-16	30-06-20	30-06-21

Description of procurement (works) as per bid document	Tender Cost (in crore Taka)		Tender		Date of completion of works	
	As per RDPP	Contracted value	Invitation date	Contract signing	As per contract	Actual
1	*2*	*3*	*4*	*5*	*6*	*7*
28. Construction of Extended L/B Guide Bundh of Bangabandhu Bridge in Jamuna River from km. 0.300 to Km. 0.750 total 450m (Package No: BRRP-CGB/17-18/Lot-01)	56.05	56.05	15-08-17	30-10-17	30-06-21	30-06-22
29. Construction of Extended L/B Guide Bundh of Bangabandhu Bridge in Jamuna River from km. 0.750 to Km. 0.900 =150 m and along the left bank & offtake of new Dhaleshwari river from km. 0.00 to km. 0.178 = 178 m total 328m (Package No: BRRP-CGB/17-18/Lot-02)	61.19	61.19	15-08-17	30-10-17	30-06-21	30-06-22
30. Construction of Extended L/B Guide Bundh of Bangabandhu Bridge in Jamuna River with protection around the mouth of New Dhaleswari offtake D/S from km. 1.2085 to km.1.500 - 291.50 m & End Termination 78.50 Total 370.00 m (Package No: BRRP-CGB/17-18/Lot-03 (e-tender ID: 483271).	Original-56.25 Revised-73.43	Original - 50.62 Revised-73.43	09-08-20	09-12-20	30-06-21	30-06-22
31. Construction of Extended L/B Guide bundh of Bangabandhu Bridge with protection around the mouth of New Dhaleswari off-take Channel D/S from km. 0.000 to km.0.1785 = 178.50 m, Turning 78.50 m., Wings 125.00 m. Total= 382.00 m. in connection with Buriganga River Restoration Project under Tangail O & M Division, BWDB, Tangail during the year 2017-2018 (Package No: BRRP-CGB/17-18/Lot-04)	Original-66.41 Revised-93.09	Original-66.38 Revised-93.09	15-08-17	30-10-17	30-06-21	30-06-22
32. Protective work for the protection of Sediment Basin by CC block for the length of 1493.00 m from erosion of the left bank of new Dhaleswari River in Upazila - Kalihati, District– Tangail.	Original-24.34 Revised - 30.55	Original-21.91 Revised-30.55	04-10-17	26-12-17	27-06-18	30-06-22
33.Operation & Maintenance Dredging works by Dredger (Offtake River dredging of new Dhaleshwari from Km (-) 0.35 to Km 0.00 and maintenance dredging of new Dhaleshwari from Km 0.00 to 2.200 and Pungli river from Km 2.00 to Km 40.00 (total 40.35 Km dredging work) under Tangail WD Division during the year FY 2015-2016.)	49.63	49.63	01-11-15	31-12-15	31-03-16	24-04-16
34. Operation & Maintenance dredging of New Dhaleswari river in between Km. 0.000 to Km. 20.00 total = 14.500 Km in Upazila - Kalihati, District - Tangail in connection with Buriganga River Restoration project under Tangail O&M Division, BWDB, Tangail during the year 2017-2018.	54.24	54.24	20-07-17	15-10-17	25-05-20	30-06-21

Description of procurement (works) as per bid document	Tender Cost (in crore Taka)		Tender		Date of completion of works	
	As per RDPP	Contracted value	Invitation date	Contract signing	As per contract	Actual
1	*2*	*3*	*4*	*5*	*6*	*7*
35. Operation & Maintenance dredging of New Dhaleswari river in between Km. 0.000 to Km. 54.00 total = 7.00 Km in Upazila - Kalihati, Basail and Mirzapur, District - Tangail in connection with Buriganga River Restoration project under Tangail O&M Division, BWDB, Tangail during the year 2021-2022.	22.78	22.78	27-08-21	31-10-21	30-06-22	30-06-22
36. Operation & Maintenance dredging of New Dhaleswari river in between Km. 0.000 to Km. 54.00 total 5.00 Km in Upazila – Kalihati Basail and Mirzapur, District - Tangail in connection with Buriganga River Restoration project under Tangail O&M Division, BWDB, Tangail during the year 2021-2022.	18.38	18.38	27-08-21	31-10-21	30-06-22	30-06-22
37. Operation & Maintenance dredging of Sediment Basin in connection with Buriganga River Restoration project under Tangail O&M Division ,BWDB, Tangail during the year 2021-2022.	28.08	28.08	20-08-21	31-10-21	30-06-22	30-06-22
38. protection of pungli railway bridge in c/w Buriganga River Restoration Project (2nd Revised) in Upazila Kalihati, District Tangail under Tangail O& M Division BWDB, Tangail during the year 2021-22	4.14	2.91	15-12-21	30-01-21	30-06-22	30-06-22
39. Foundation Treatment of bridge constructed by RHD as deposit work	4586.40	655.20	-	20-03-22 (MoU)	30-06-22	30-06-22
40. Foundation Treatment of bridges constructed by LGED as deposit work	415.75	415.75	-	12-06-18 (MoU)	30-06-21	30-06-21

b) Consultancy of the Project costing above Tk. 100.00 lakh:

Description of procurement (works) as per bid document	Tender Cost (in crore Taka)		Tender		Date of completion of works	
	As per RDPP	Contracted value	Invitation date	Contract signing	As per contract	Actual
1	*2*	*3*	*4*	*5*	*6*	*7*
Consultancy Services of Mathematical Modelling for Offtake Management of the New Dhaleswari River and Hydraulic Monitoring of New Dhaleswari-Pungli-Bangshi-Turag-Buriganga System.	2.00	2.00	25-10-10	11-01-11	Original-10-01-14 Revised-30-06-19	30-06-19
Consultancy Services for Physical Model Investigation for Sustainability of the Buriganga River Restoration Project	1.00	0.95	19-04-17	13-06-17	Original-12-10-17 Revised-30-05-20	30-05-20

8.2 Use of Project Consultant (s) (Foreign/Local):

Name of the Field	Approved man month		Actual man month utilized	Remarks
	As per PP	As per contract		
1	2	3	4	5
(a) Foreign:	N/A			
(b) Local:				
1. Consultancy Services of Mathematical Modelling for Offtake Management of the New Dhaleswari River and Hydraulic Monitoring of New Dhaleswari-Pungli-Bangshi-Turag-Buriganga System				Conducted by IWM. Executive summary of the study is attached her with as Annexure-i
1) Team Leader	18	18	18	
2) Morphological Modelling Specialist	9	9	9	
3) Hydrodynamic Modelling Specialist	6	6	6	
4) Hydrological Modelling Specialist	3	3	3	
5) Design /River Training Specialist	3	3	3	
6) Quality Control & Monitoring Engineer	18	18	18	
7) Water Quality Specialist	3	3	3	
8) GIS Specialist	2	2	2	
9) Field Engineer	18	18	18	
10) Data Analyst	18	18	18	
2. Consultancy Services for Physical Model Investigation for Sustainability of the Buriganga River Restoration Project				Conducted by RRI. Executive summary of the study is attached herewith as Annexure-ii
1) Team Leader	1	1	1	
2) Senior Hydraulic Modeler	3	3	3	
3) Hydraulic Modeler	3	3	3	
4) Data Analyst	2	2	2	
5) Maintenance Engineer		1	1	

09. Construction/Erection/Installation of Tools & Equipment:

Description of items	Quantity (as per DPP)	Quantity procured with date	Transferred to O & M with date	Disposed of as per rule with date	Balance	Remarks
1	2	3	4	5	6	7
Multimedia/ Projector machine	1 set.	30-06-2011	Planning-1, BWDB, Dhaka, Date: 26-07-11		1 set.	Used for official purpose
Computers (PC)	3 nos.	30-06-2011	1 no, Tangail WD Division, Date: 27-07-11, 1 no, Mymensingh O& M circle, Date: 04-08-11		3 nos.	
Computers (Laptop)	1 no.	30-06-2011	Planning-1, BWDB, Dhaka, Date: 26-07-11		1 no.	
Printers.	3 nos.	30-06-2011	1 no, Tangail WD Division, Date: 27-07-11, 1 no, Mymensingh O& M circle, Date: 04-08-11		3 nos.	
Photocopier	2 nos.	30-06-2011	-		2 nos.	
Fax machine	1 nos.	30-06-2011	-		1 nos	

C. FINANCIAL AND PHYSICAL PROGRAMME:

01. (a) Original and revised schedule as per DPP:

(In lakh Taka)

Financial Year	Financial provision & physical target as per original DPP				Financial provision & physical target as per latest revised DPP			
	Total	Taka	P.A.	Physical %	Total	Taka	P.A.	Physical %
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
2009-10	47.00	47.00	-	0.05%	-	-	-	-
2010-11	1986.01	1986.01	-	2.10%	579.00	579.00	-	0.51%
2011-12	28943.49	28943.49	-	30.66%	1524.98	1524.98	-	1.35%
2012-13	46543.02	46543.02	-	49.30%	4322.70	4322.70	-	3.84%
2013-14	16889.55	16889.55	-	17.89%	2910.54	2910.54	-	2.59%
2014-15	-	-	-	-	2278.82	2278.82	-	2.02%
2015-16	-	-	-	-	2485.76	2485.76	-	2.21%
2016-17	-	-	-	-	15270.48	15270.48	-	13.57%
2017-18	-	-	-	-	1999.46	1999.46	-	1.78%
2018-19	-	-	-	-	7498.98	7498.98	-	6.66%
2019-20	-	-	-	-	16656.61	16656.61	-	14.80%
2020-21	-	-	-	-	18977.26	18977.26	-	16.86%
2021-22	-	-	-	-	38054.74	38054.74	-	33.81%
Total =	**94409.07**	**94409.07**	**-**	**100.00%**	**112559.33**	**112559.33**	**-**	**100.00%**

01. (b) Revised ADP allocation and progress:

(In lakh Taka)

Financial Year	Revised Allocation & target				Taka release	Expenditure & physical progress			
	Total	Taka	P.A.	Physical %		Total	Taka	P.A.	Physical %
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
2009-10	-	-	-	-	-	-	-	-	-
2010-11	584.50	584.50	-	0.51%	583.00	579.00	579.00	-	0.51%
2011-12	1525.00	1525.00	-	1.35%	1525.00	1524.98	1524.98	-	1.35%
2012-13	4330.00	4330.00	-	3.84%	4323.14	4322.70	4322.70	-	3.84%
2013-14	2937.00	2937.00	-	2.64%	2936.02	2910.54	2910.54	-	2.59%
2014-15	2300.00	2300.00	-	2.20%	2300.00	2278.82	2278.82	-	2.02%
2015-16	2500.00	2500.00	-	3.21%	2500.00	2485.76	2485.76	-	2.21%
2016-17	15412.00	15412.00	-	12.26%	15412.00	15270.48	15270.48	-	13.57%
2017-18	2000.00	2000.00	-	1.89%	2000.00	1999.46	1999.46	-	1.81%
2018-19	7500.00	7500.00	-	8.00%	7500.00	7498.98	7498.98	-	8.00%
2019-20	18700.00	18700.00	-	15.50%	16682.50	16656.61	16656.61	-	15.50%
2020-21	19000.00	19000.00	-	28.85%	18988.85	18977.26	18977.26	-	28.85%
2021-22	20200.00	20200.00	-	19.75%	20200.00	14741.81	14741.81	-	14.64%
Total =	**96988.50**	**96988.50**	**-**	**100.00%**	**94950.51**	**89246.40**	**89246.40**	**-**	**94.89%**

D. ACHIEVEMENT OF OBJECTIVES OF THE PROJECT:

Objectives as per DPP	Actual achievement	Reasons for shortfall, if any
(a) Improvement of water quality through enhancement of dry season flow in the Buriganga & Turag River system.	(a) Dry season flow in the Burigonga & Turag River System has been enhanced by increasing the flow intake capacity of the off-take through River dredging and maintenance dredging works implementation. It has overall improved the water quality in the mentioned river system.	-
(b) To ensure adequate draft in the Buriganga & Turag River system so that river crafts may ply round the year.	(b) Adequate draft in the Burigonga and Turag River have been ensured by the implementation of river dredging work	-
(c) Irrigation and fisheries development.	(c) Development of irrigation (availability of water for irrigation) and fisheries have been achieved by re-excavation and dredging of the dead river/channel to increase their water carrying capacity under the project.	-
(d) Improvement of overall economic, social & environmental condition.	(d) The existing rivers and the branch canals were no-flow or dead river for a long time. The implementation of the dredging and re-excavation works under the project have made the river live and flowing with significant discharge. This is one of the main reasons to improve the overall economic, social and environmental condition of the project area.	-
(e) Control of unauthorized encroachment along Buriganga River	(e) During the implementation of the project, the existing unauthorized encroachment had been removed by eviction process and it will continue if required in future.	-

E. BENEFIT ANALYSIS

01. Annual Out-put:

Items of out-put	Unit	Estimated quantity expected at full capacity	Actual quantity of out-put during the 1st year of operation at full capacity (or during, real production for newly completed project).
1	2	3	4
Agriculture/Paddy Production	Mt.	455457.45	This Project has just been completed. Actual output value can be assessed after a year from completion.
Fisheries Resource	Mt.	200.00	

02. Cost / Benefit:

Item	Estimated	Actual
1	2	3
(1) Benefit cost ratio of the project (i) Financial	(1) B/C Ratio (i) 1.28: 1	Will be evaluated later by concern directorate of BWDB & IMED.
(ii) Economic	(ii) 1.47: 1	
(2) Internal Rate of Return (i) Financial	(2) Internal Rate of Return (i) 16.33%	
(ii) Economic	(ii) 18.94%	

03. Please give reasons for shortfall, if any, between the estimated and actual benefit: **N/A**

F. MONITORING AND AUDITING

0.1 Monitoring:

Name & designation of the inspecting official	Date of Inspection	Identified Problems	Recommendations
1	2	3	4
(a) Ministry/Agency			
1. Mr. Zaheed Farooque, MP Hon'ble State Minister, MoWR (During the visit, the Additional Director General (Eastern Region), BWDB; the Chief Engineer Central Zone, BWDB and Project director, BRRP and Chief Engineer, Design, BWDB, Dhaka was present at site of the project.	02-06-2022	-	i) Maintenance dredging should be continued towards off-take of the new Dhaleshwary River so that siltation occurred during the dredging works implementation can be removed again and the flow of water can enter in to the Burigonga River system smoothly. ii) The damaged slope of the guide bundh should be rebuilt by dumping geo-tube of at least 4m long which was used to build the damaged riverbank at end termination works at downstream. iii) It is observed that the flowing patter of the active channel had been changed severely from upstream towards downstream of the Bangabandhu bridge, therefore the design of the launching apron of the guide bundh should be reviewed by the concern design office of the BWDB.
2. Mr. Kabir Bin Anwar Senior Secretary Ministry of Water Resources	12-06-2021	-	i) After completion of maintenance dredging at the off-take of the new Dhaleshwari River, the discharge water flow has been increased in the downstream and the increased amount should be measured perfectly. ii) The sand stacks visible on the riverbank, which was extracted by Sediment Basin dredging should be dressed and leveled in a regular manner and also should covered by geo-bags, so that the land developed by the dredged sand can't eroded by river flow or rain and could be used for tree plantation and/or for the housing of land and homeless

Name & designation of the inspecting official	Date of Inspection	Identified Problems	Recommendations
1	2	3	4
			peoples of the country. iii) The unprotected 420-meter length of new Dhaleshwari river left bank from the end of the protection work implemented by lot-2 up to the starting point of the sediment basin protection work, should be protected by geo-bag dumping and placing works.
3. i) S. M Rezaul Mostafa Kamal, Addl Secretary (planning), MoWR. ii) Abu Yousuf, Joint Secretary, Ministry of Finance	11-06-2022	-	The team visited the project in order monitor the implementation status of the all component of the project. The Guide bundh, off-take management, maintenance dredging and sediment basin maintenance dredging had been observed. They have instructed to complete the project in stipulated time.
4. A H M Anwar Pasha Deputy Secretary, MoWR	24/12/2020 to 26/12/2020	The said part of Turag River has a lot of dirt, garbage, polythene and tree dust and the nature of the soil is sticky and hard, and dredging is very difficult and time consuming, so the desired progress of the work is not being achieved.	Contractors engaged in ongoing work need to be given a quick reminder to take necessary measures to expedite the progress of work at a proportionate rate to complete the work within the stipulated time.
1. i) Mr. Akhil Kumar Biswas Additional Director General (East Region), BWDB, Dhaka. ii) Mr. Md. Abdul Matin Sarkar, Chief Engineer, Central Zone, BWDB, Dhaka & Project Director	21-12-2021	Only two cutter suction dredgers of which one is 26-inch dia and the other is 20-inch dia dredger are mobilized at site. But dredgers could not run as per the requirement due to the lack of fuel supply or timely fuel supply at dredgers. Sometimes the dredgers have to shut downed for about two to three days due to uninterrupted supply of fuel at site.	i) The necessary action should be taken to complete the uncompleted works of the lots of the Guide Bundh immediately. ii) The C. C. block remaining scattered on the slope of the Guide Bundh, should be removed immediately and the block dumping work should be implemented in an equal and continuous manner as per the provision of the approved design. iii) Variation proposal for the upstream and downstream end protection/end connection should be summited immediately. iv) Narayangonj Dredger directorate has been instructed hereby to implement the maintenance dredging works of Sediment Basin immediately. v) The contractors engaged to implement the maintenance dredging works of Pungli River should be instructed to mobilize the necessary numbers of dredger in order to complete the dredging works within the stipulated time. vi) All concern officials and contractors are hereby instructed by Additional Director General (Eastern Region) to take every initiative necessary to complete the works within the stipulated time.
2. i) Mr. Enayet Ullah, Chief Engineer, Design, BWDB, Dhaka. ii) Mr. Md. Abdul Basit, Superintending Engineer, Design Circle-1, BWDB, Dhaka.	25-09-2021	-	The expert design team had visited the eroded the Jamuna River left bank just upstream of Lot-1 protective work of guide bundh in order to observe the scour depth and nature of scouring at site. They ask field officials to plot the cross-section of eroded part of river reach and instruct to send the cross-section data to design office.

Name & designation of the inspecting official	Date of Inspection	Identified Problems	Recommendations
1	2	3	4
3. i) Mr. Md. Motahar Hossain, the former Addl DG (Planning, Design & FS), BWDB, Dhaka ii) Mr. Md. Mahbur Rahman, Addl DG (Eastern region), BWDB, Dhaka iii) Mr. Abdul Basit Superintending Engineer, Design Circle-1, BWDB, Dhaka.	15-10-2021	-	The eroded Jamuna Riverbank at the upstream of guide bundh which was under construction by BWDB and at the downstream of the guide bundh already constructed by BBA had been visited by the BWDB expert team and then prepared a design for implementing the upstream end protection works and the same at downstream.
4. i) Mr. Md. Abdul Matin Sarkar, Chief Engineer, Central Zone, BWDB & Project Director, BRRP. ii) Mr. Md. Abdul Basit Superintending Engineer, Design Circle-1, BWDB, Dhaka	27-04-2022	-	i) The damage slope of guide bundh constructed under Lot-3 site had been visited and asked concern Executive Engineer to implement a detailed bathymetric survey by eco-sounder for the preparation of cross-sections at damaged site and sent it to the design office for review the approved design.
5. i) Mr. Abdul Matin Sarkar, Chief Engineer, Central Zone, & PD, BRRP, BWDB, Dhaka. ii) Mr. Enayet Ullah, Chief Engineer, Design, BWDB, Dhaka.	07-06-2022	-	The team of expert including project director of the project had visited the damaged slope of protective work of Lot-3 and delivers their important suggestion to stop the bank erosion at site so the damages of slope can't propagate to further extend.
(b) IMED			
1. Mr. Khondakar Mohammad Ali Director, Sector-4	02-12-2019	-	i) The remaining works of the project should be implemented after formulation of a realistic work plan. Then the works should be kept under close monitoring for timely completion. ii) The implementation of guide bundh construction under 3 nos. lots need to be completed and the work order of the other lot must be issued after the completion of the re-tender evaluation process, so that the whole work of the guide bundh construction can be finished before upcoming rainy season, iii) To resolve the complexity of the land acquisition necessary for the construction of Sediment Basin and Guide Bundh construction under the project, the required help may be acquired from the local Administration and concern public representatives. iv) Excavation of Sediment Basin must be completed otherwise the dredging works to be implement in both Pungli and Bonhshi river will not be fruitful. After completing the land acquisition, excavation of Sediment Basin, maintenance dredging and the Bongshi

Name & designation of the inspecting official	Date of Inspection	Identified Problems	Recommendations
1	2	3	4
			River dredging works should start simultaneously. v) A considerable part of the project needs to be completed in a short time. As an important and expensive project, a full-time project director should be appointed. vi) Over-sized Stone chips should not use to manufacture the C. C. blocks and should be removed from the site. vii) All necessary steps should be taken to complete the project within the stipulated time and cost as per the latest RDPP. viii) All the works of the project implementation must be ensured as per the design and specification of the approved DPP of the project. ix) All latest information of the project incorporation in the PMIS of IMED need to be ensured.
2. Ms. Kaniz Mawla Deputy Director, IMED	22-01-2019	The project is a priority project promised by Honorable Prime Minister. The Water Development Board did not have proper information about the width and depth of connecting of river system, due to lack of updated feasibility study before approving the project. Therefore, the plan/work has to be changed several times and is being done. On the one hand, there is a wastage of time, on the other hand, the cost and duration of the project have increased by 19.22% and 233.33% respectively.	i) If possible before the works which have not yet started, it is necessary to prepare a proper action plan by collecting and using/analyzing existing and real data. ii). the works which have already taken too much time, strategic plan formulation and CPM (Critical Path Method) method can be developed to complete the work within project's stipulated time. iii). Appointment of full-time project managers and round-the-clock monitoring & implementation mechanisms need to be strengthened on an urgent basis.
(c) Others: (Please specify)		-	

0.2. Auditing during and after Implementation:

2.1. Internal Audit: Not conducted.

Period of Audit	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.
1	2	3	4
----------N/A----------			

2.2. External Audit:

Audit period	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.
1	2	3	4
2010-2011 to 2019-2020	23-12-2020	Total BDT 125733063.00 revenue loss due to the non-submission of the value of 83822042.25 cft sand in the concern account of Board.	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	Immovable property acquisition act, 1997 had been ignored during the payment made in a increased rate for acquisition of land, a total of 804378935.00 taka financial loss of board had been occurred.	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	Due to not taken an action to forfeiture of the tender security amounting 20,00,000.00 taka, a total financial loss of Board had been occurred.	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	Excess Payment of 32,13,63,890.00 taka made in favor of the c.c. blocks which were not counted by Taskforce a financial loss of BWDB Board had been occurred.	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	Excess Payment of BDT 3,69,848.00 taka made by showing excess volume measured than the volume measured by Taskforce	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	At the end of the implementation period, slow progress of the on-going work makes the project implementation uncertain.	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	The contractor fails to complete the works implementation within the stipulated time, needs to fine as liquidated damage of amount 4,07,15,459.00 which will be treated as financial loss of Board of BDT 4,07,15,459.00 taka.	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	Paragraph No-7: Project implementation is uncertain for slow pace works at the end of the project period. Paragraph No-9: Revenue loss of Tk.7,61,917/- to the Government on account of VAT due to non-insurance by the contractor in the contract. Paragraph No-12: Rules of PPR-2008 are disregarded for non-acceptance of bank guarantee as performance security of Tk.3,96,57,689.00 in Direct Purchase Agreement (DPM). Paragraph No-13: Financial loss of Tk.4,07,15,459/- to the Board due to non-deduction of Liquidity Damage (LD) from the contractor who failed to perform the work within the stipulated time.	Memo No - 80 Dated: 18/04/2022: Objections to paragraph No-9 have been disposed of. Other objections have been answered. Not resolved yet.

Audit period	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.
1	2	3	4
2019-2020 to 2020-2021	20-01-2022	Paragraph No-8: Irregular payment of Tk.75,03,95,210/- towards earth excavation bill without pre-work and post-work measurement report by Task Force. Paragraph No-12: Financial loss to the Government on account of VAT at the prescribed rate on the insurance premium due to failure to insurance the contract value by the contractor is Tk.2,18,15,411/-.	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	Para no. 7: Uncertainty regarding completion of project due to slow progress	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	Para no. 10: Advance payment of Tk. 41829301 violating cabinet division and PPR-2008 rules	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	Para no. 11: Approving direct Procurement Contract (DPM) of Tk.341424596 in violation of PPR-2008.	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	Para no. 12: Not receiving performance guarantee of Tk. 34136460 for direct Procurement Contract (DPM) in violation of PPR-2008.	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2010-2011 to 2019-2020	23-12-2020	Paragraph No-6: Waste of money by Board in formulating DPP through flawed feasibility studies	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.
2009-10 to 2013-14	26-10-2014	Paragraph No-4: Expenditure of Tk 50,00,000/- of the government showing purchase of jeeps without requirement in Buriganga River Restoration project.	Objection resolved
2009-10 to 2013-14	26-10-2014	Paragraph No-5: Even though the speed boat was not purchased expenditure of Tk 100000/- of the government was incurred by showing fake purchase.	Objection resolved
2009-10 to 2013-14	26-10-2014	Paragraph No-8: Without DPP amendment tk. 10,00,000/- expenditure incurred for jeep purchase	Objection resolved
2016-17	27-02-2018	Paragraph No-14: Despite having a dredger department of BWDB for dredging work, without allowing the dredger department to work at the estimated rate, violation of the rule 74 of PPR 2008, the contract was completed without tender at an additional rate of the estimated value and bill was paid so financial loss of the government is Tk. 1,86,67,159/-	A broadsheet reply already had been submitted along with the necessary evidences. Not resolved yet.

G. DESCRIPTIVE REPORT

1. General Observations/Remarks of the Project on:

1.1 Background:

During the last decades, the water flow of the Buriganga, Turag, Shitalakhya and Balu rivers declined significantly. The water of these rivers became polluted due to industrial discharge, the indiscriminate disposal of toxic chemicals and the dumping of human waste into rivers and canals. With the constant increase of population and subsequent socio-economic activities, the inland ports in Dhaka and Narayangonj are becoming heavily congested. Earlier many of the khals, lakes and canals were connected with the peripheral waterways which have either been closed or disconnected through encroachment or other interventions. Hence the problem of pollution and environmental degradation of Buriganga and other linked rivers around Dhaka are posing serious threat to public health, ecosystem and socio-economic life of the people since long.

Moreover, due to hydraulic and morphological changes in the rivers around Dhaka and gradual sedimentation in the Buriganga, Turag, Balu & Shitalakhya river systems, the conveyance capacities of the rivers have been decreased, causing no flow condition during the dry season and consequently the navigation drafts have been reduced. The feeder river from the source of the Jamuna does not receive flows due to drying up of the off-takes during the dry season. Heavy sedimentation at the off-takes and river reaches is another major problem in achieving sustainable development. Off-takes management is therefore, the key factor to the sustainability of the augmentation.

The issue of mitigation of river pollution was discussed in many seminars and symposium. It also focused in press and electronic media. BWDB through IWM conducted a feasibility study in the name & title "Feasibility & Mathematical Model Study of Approaching and Investigating Strategy for Rehabilitating the Buriganga-Turag-Shitalakhya River System and Augmentation of Dry Season Flow in the Buriganga River during August 2004. Based on that feasibility study a DPP and PDPP for the project named "Augmentation Buriganga flow by silted uplinks with Jamuna was prepared for an amount of Tk. 61058.80 lakh and submitted to the Planning Commission through Ministry of Water Resources during January, 2006. But DPP was not approved for non-availability of Donors.

Then Honorable Prime Minister of the Government of the People Republic of Bangladesh has taken up the issue of river pollution and siltation problem more seriously toward its solution on priority basis. Further directives have also been given by the Honorable Prime Minister in the meeting held on 25-08-2009 in the 1st meeting on Water Sector and Dredging related committee for the dredging of the river system around Dhaka City. The Honorable High Court also issued directives to take necessary action to make the rivers around Dhaka City free from encroachment and pollution. Similar directives have been issued from "The Government Institution Committee" of the National assembly in their 11th meeting held on 17.06.2009 to take initiatives for saving the river Buriganga by increasing its flow through augmentation.

With a view to above the project "Restoration of Buriganga River" (New Dhaleswai-Pungli-Bangshi-Turag-Buriganga River system) is prepared studying all the findings of the previous records and reports in this connection to save the river Buriganga and others from pollution through Augmentation of flow from the Jamuna. The proposed project is planned for implementation in 5 (five) years. It may be stated here that siltation in the upstream of the off-take regulator may be occurred in the post project period for which a mathematical model study will be conducted through IWM under this project and based on the findings of the study if needed BWDB dredger will be

engaged for regulator off-take management as per need. But in the downstream of the off-take siltation problem will be reduced significantly due to gated off-take regulator and annual maintenance of the downstream will be done from regular revenue budget.

Therefore, the DPP of the project had been approved by ECNEC on 06 April, 2010 consisting of toatl project cost BDT 94409.07 Lakhs and project implementation period from April, 2010 to December, 2013.

1.2 Justification/Adequacy

The water flow of Buriganga, Turag, Sitalakhya and Balu rivers declined significantly. The water of these rivers became polluted due to industrial discharge, the indiscriminate disposal of toxic chemicals and the dumping of human waste into rivers and canals. With the constant increase of population and subsequent socio-economic activities, the inland ports in Dhaka and Narayangonj are becoming heavily congested. Earlier many of the khals, lakes and canals were connected with the peripheral waterways which have either been closed or disconnected through encroachment or other interventions. Hence the problem of pollution and environmental degradation of Buriganga and other linked rivers around Dhaka are posing serious threat to public health, ecosystem and socio-economic life of the people since long.

The issue of mitigation of river pollution was discussed in many seminars and symposium. It also focused in press and electronic media. The Honorable Prime Minister of the Government of the People Republic of Bangladesh as taken up the issue of river pollution and siltation problem more seriously toward its solution on priority basis. In the 1st meeting on "Water Sector and Dredging related committee" held on 25-08-2009 the Honorable Prime Minister hand instructed for the dredging of the river system around Dhaka City. The Honorable High Court also issued directives to take necessary action to make the rivers around Dhaka City free from encroachment and pollution.

The Project will directly increase agricultural and fish production in the area. Thus, the hardline poverty will be alleviated by virtue of both increase in income and employment. The most affected groups, being daily laborer, will be directly benefited from enhanced employment in construction works, other related works as well as expanding agricultural and Fisheries sector. The project will provide significant employment opportunities due to creation of navigational facilities. As wages increase, consumption of daily food and other necessities by poor households will also increase, thereby reducing the extent of poverty line in the project area. In addition to that due to improvement of water pollution diseases will be reduced and there by expenditure for health and treatment will be minimized.

1.3 Objectives

Main objectives of the project are:

- Improvement of water quality through enhancement of dry season flow in the Buriganga & Turag River system.
- To ensure adequate draft in the Buriganga & Turag River system so that river crafts may ply round the year.
- Irrigation and fisheries development.
- Improvement of overall economic, social & environmental condition.
- Unauthorized encroachment control along Buriganga River.

1.4 Project revision with reasons

1st Revision

During implementation, the Project faced some severe problems such as:

(i) The New Dhaleswari off-take where intake water enters from the Jamuna River was silted up and new char developed at this point.

(ii) 22 nos bridges are located at different points of the river route, which was constructed by LGED, RHD and Bangladesh Railways. Due to excavation of the river route, the foundation of these bridges may be damaged.

The matter was discussed in the Project Technical committee meeting, Water Resources expert personnel meeting and the project steering committee meeting. The Problems were also discussed in the meeting held on 21.05.2014 chaired by the Senior Secretary, Honorable Prime Minister office. By the decision of the meeting, an inter-ministerial committee was formed with the representative from different organization/Ministry. The Committee visited the site and submitted a report with recommendation. The recommendation of the committee was foundation treatment works of 22 bridges to be included in the RDPP

Honorable Minister of Water Resources visited the project site on 21.10.2015. He has witnessed severe siltation in the offtake of the New Dhaleswari river and he also observed the siltation in New Dhaleswari-Pungli River system. A non-binding MoU signed on 02-07-2015 in between BWDB and Chana AVIC-ENG & CHWE JV for feasibility study to carry out sustainable completion of the project. Chana AVIC-ENG & CHWE JV submitted final report on December 2015(executive summary attached as annexure-iii). Considering the prevailing situation, recommendation of the inter-ministerial committee, recommendation of the study report conducted by the Chana AVIC-ENG & CHWE JV, the recommendation of the Technical Committee, and the decision of the steering committee meeting held on 14.01.2016, and also the instruction of the Honorable Minister, Ministry of Water Resources the DPP was revised. In the RDPP, the Offtake & Fish pass regulators were dropped from the original DPP and the inclusion of sediment basin in the off-take area & inclusion of foundation treatment works of the existing bridges along the river route. The RDPP of the Project was approved by ECNEC on 14.06.2016 with a cost of tk. 112559.33 lakh for the implementation period April/2010 to June/2020.

2nd revision:

Land acquisition provision has been kept in the 1st RDPP for construction of sediment basin and guide bundh is 85.00 hac with a cost of Tk. 178.74 crore. Land Acquisition proposal for Sediment Basin and guide bundh was submitted to Deputy Commissioner, Tangail by the executive Engineer, BWDB, Tangail on 04.08.2016. Administrative Approval from Ministry of Land has been received on 31.10.2017 and estimate has been received from the deputy commissioner office on 30.07.2018. Estimated value for land acquisition of 68.39 hac Sediment basin is Tk. 227.27 crore and tentative estimated value for land acquisition of 15.09 hac guide bundh is taka 36.65 crore in total taka is 263.92 crore only. So that; for land acquisition purpose additional Tk. 103.57 crore is needed from the 1st RDPP provision. Construction of guide bundh has provision Tk 19508.86 lakh only in the 1st RDPP but as per approved design and then update schedule of rates of Mymensingh O&M Circle, BWDB, Mymensingh the estimated value of the said works was Tk 24187.88 lakh which was Tk 4679.02 lakh increased from the 1st RDPP provision. On the other hand, the cost of Maintenance dredging was decreased 7874.27 lakh from the 1st RDPP provision because Maintenance dredging was not done in the financial year 2016-17 and 2017-18 due to the

decision of the meeting held on 05.12.2016 chaired by the Honorable Minister, Ministry of Water Resources. Cost of River dredging also decreased in Tk 3725.81 lakh from the 1st RDPP provision due to auto dredging in the river Bangshi in last two monsoons. The issues were discussed in the Project Implementation Committee (PIC) meeting held on 14.08.2018 and Project Steering Committee (PSC) meeting held on 06.09.2018. According to decisions taken both the meetings, to overcome the land acquisition and other problem 1st RDPP inter item cost adjustment needed to be done within short time. A meeting of the Divisional Project Evaluation Committee (DPEC) was held on 30.09.2018 chaired by the Secretary, Ministry of Water Resources in the conference room of Ministry. Proposed 2nd Revision of the DPP was prepared as per decisions of DPEC meeting held on 30.09.2018. The PEC meeting was held on 28.11.2018 at planning commission chaired by the Member, Agriculture, Water Resources & Rural Institution Division of Planning commission. The RDPP has been recast with compliance of the recommendation of the PEC meeting and the cost of the stands to Tk. 112559.33 lakh only and project period also proposed up to June/2021. The 2nd RDPP of the Project approved by honorable planning minister on 24/07/2019 with a cost of tk. 112559.33 lakh for implementation period April/2010 to June/2021.

2. Rationale of the project in respect of Concept, Design, Location and Timing.

The problem of pollution and environmental degradation of the Buriganga and other linked rivers around Dhaka City are posing serious threat to public health, ecosystem and socio-economic life of the people since long. For the improvement of water quality and to ensure navigation draft through enhancement of dry season flow in the Buriganga & Turag River system by the dredging of Pungli-Bangshai-Turag River system the project was taken up by BWDB. The project was designed by the construction of a guide bundh, offtake regulator & Fish pass regulator on the left bank of the Jamuna River which is the off-take of New Dhaleswari River and situated at Kalihati upazilla, Dist- Tangail. Another major component of the project was river dredging by dredgers & excavators in the Pungli River and river dredging by dredgers in the Bangshai & Turag Rivers. During the implementation of the project, severe siltation occurred in the offtake area of the project. Observing the severe siltation in the offtake of the New Dhaleswari and newly developed char in Jamuna River in front of the offtake and also the siltation in the New Dhaleswari-Pungli River system. Considering the prevailing situation, the decision of the steering committee meeting held on 14.01.2016 and the recommendation of the Technical Committee, Experts and study conducted by the China the Chana AVIC-ENG & CHWE JV, the design of the project was reviewed. The DPP was revised without Offtake & Fish pass regulators and inclusion of sediment basin & foundation treatment of the existing bridges along the augmented route. This revised planning & design of the project has increased dry season flow at Turag & Buriganga River. Water quality has improved. An overall positive impact on ecosystem.

The Project will directly increase agricultural and fish production in the area. Thus, the hardline poverty will be alleviated by virtue of both increase in income and employment. The most affected groups, being daily laborers, will be directly benefited from enhanced employment in construction works, other related works as well as expanding agricultural sector. The project will provide significant employment opportunities due to creation of navigational facilities. As wages increase, consumption of daily food and other necessities by poor households will also increase, thereby reducing the extent of poverty line in the project area. In addition to that due to improvement of water pollution diseases will be reduced and there by expenditure for health and treatment will be minimized.

3. Brief description on planning and financing of the project and its applicability.

- Project Identification

The Buriganga river pollution is a burning issue in Bangladesh. The issue of mitigation of the Buriganga river pollution was discussed in many seminars and symposium for years. It also focused on press and electronic media. BWDB conducted a feasibility study through IWM in August 2004. Based on that feasibility study BWDB was taken up the project.

- **Project Preparation**

The Honorable Prime Minister of the Government of the People Republic of Bangladesh has taken up the issue of river pollution and siltation problem more seriously toward its solution on priority basis. Further directives have also been` given by the Honorable Prime Minister in the meeting held on 25-08-2009 in the 1st meeting on Water Sector and Dredging related committee for the dredging of the river system around Dhaka City. The Honorable High Court also issued directives to take necessary action to make the rivers around Dhaka City free from encroachment and pollution. Similar directives have been issued from "The Government Institution Committee" of the National assembly in their 11th meeting held on 17.06.2009 to take initiatives for saving the river Buriganga by increasing its flow through augmentation.

With a view to above BWDB and MoWR had been taken initiatives to formulate the project.

- **Appraisal**

As per the decision of the appraisal Committee meeting held at the planning commission, the DPP was recast by the BWDB and sent to the Ministry of Planning for approval.

- **Credit Negotiation-** Not applicable
- **Credit Agreement**- Not applicable
- **Credit Effectiveness**- Not applicable
- **Loan Disbursement**-Not applicable
- **Loan Conditionalities**- Not applicable
- **Project Approval-**

The DPP of the project had been approved by ECNEC on 06 April, 2010 consisting of total project cost BDT 94409.07 Lakhs and project implementation period from April, 2010 to December, 2013. The DPP was revised without Off take & Fish pass regulators and inclusion of sediment basin & related works, foundation treatment of the existing bridges along the augmentation route. The RDPP of the Project approved by ECNEC on 14.06.2016 with a cost of tk. 112559.33 lakh for implementation period April/2010 to June/2020. Thereafter land acquisition problem arises and to resolve the problem the 2nd RDPP of the Project was approved by the Honorable Minister, Ministry of Planning on 24/07/2019. The Project implementation cost is tk. 112559.33 lakh and implementation period April/2010 to June/2021.

- Others (if any)- N/A

4. Analysis of the Post-Implementation situation and result of the project:

4.1 Whether the beneficiaries of the project have clear knowledge about the Target/ Objectives of the project. Yes.

4.2 Programme for use of created facilities of the project

The stakeholders are directly taking advantages of the created facilities of the project.

4.3 O & M programme of the project.

Maintenance dredging in sediment basin will be done by BWDB dredger if sufficient O&M budget is allocated.

4.4 Impact of the project -

4.4.1 Direct

- Improvement of water quality through increasing dry season flow in the Buriganga & Turag River system.
- Improved navigability on augmented river route.
- Positive impact on fishers & agriculture.

4.4.2 Indirect

Improvement of overall economic, social & environmental condition.

4.5 Transfer of Technology and Institutional Building through the project

Not Applicable

4.6 Employment generation through the project.

Due to project interventions, areas where creation of notable amount of employment opportunities anticipated are:

a) Job opportunity in river re-excavation

b) Job opportunity in boost up agriculture

c) Job opportunity in city extension works

d) Job opportunity in boost up culture fishery and fish catch

e) Job opportunity in navigation in lieu of road communication

f) Job opportunity in trade and commerce

g) Participatory process in implementation.

h) Employment generation for skilled and unskilled labor.

4.7 Possibility of Self employment

The project will provide significant employment opportunities due to restoration of navigational facilities. Factories and industries will be set up by the entrepreneur beside the river route. People will be able to generate self-employment in their locality.

4.8 Possibility of women-employment opportunity

In the changed socio-economic situation women are compelled to migrate increasingly to urban areas in search of employment. Implementation of the Buriganga River Restoration Project will directly create huge employment opportunity for rural women. Factories and industries will be setup along the river route, many of the women will be able to have employment remaining in their locality and thereby avoiding the odds of living isolated from their family and the locality. Constant presence of water in the rivers will reduce hardship of women along the rivers in performing their daily household activities.

4.9 Women's participation in development

Yes.

4.10 Probable Impact on Socio-Economic activity.

The most affected groups, being daily laborer, are directly benefited from enhanced employment in construction works, other related works as well as expanding

agricultural sector. The project will provide significant employment opportunities due to creation of navigational facilities. As wage increase, consumption of daily food and other necessities by poor households will also increase. Implementation of the Buriganga River Restoration Project will directly create huge employment opportunity for rural man/women. Factories and industries will be setup along the river route, many of the women will be able to have employment remaining in their locality and thereby avoiding the odds of living isolated from their family and the locality. Hence, socio-economic balance in the locality has been achieved.

4.11 Impact on environment

Environmental impact was assessed by study team during project implementation and no adverse impact was identified by ongoing interventions. The main objective of the project is, to improve water quality through enhancement of dry season flow in the Buriganga & Turag River system and pollution will be reduced. So, the project is environment friendly.

4.12 Sustainability of the project

The project will be sustainable provided maintenance dredging is ensured in the sediment basin and offtake area in every year.

4.13 Contribution to poverty alleviation/reduction

The project will directly increase agricultural and fish production in the area. Thus, the hardline poverty will be alleviated by virtue of both increase in income and employment. The most affected groups, being daily laborer, will directly benefited from enhanced employment in construction works, other related works as well as expanding agricultural sector. The project will provide significant employment opportunities due to creation of navigational facilities. As wage increase, consumption of daily food and other necessities by poor households will also increase, thereby reducing the extent of poverty line in the project area.

4.14 Opinion of the public representatives, local elite, local administration, teachers, religious leaders, women's representatives etc.

Positive remarks regarding the Project.

4.15 Contribution of Micro-credit programmes and Comments on overlapping with any NGO activities.

Not Applicable.

5. *Problems encountered during Implementation (with duration & steps taken to remove those)*

5.1 Project Management: *Didn't arise.*

5.2 Project Director: *Didn't arise.*

5.3 Land Acquisition: For the project implementation Land acquisition was one of the major problems. It was took lot of time.

5.4 Procurement: *Didn't arise.*

5.5 Consultancy: *Didn't arise.*

5.6 Contractor: *Didn't arise.*

5.7 Manpower: *Didn't arise*

5.8 law & Order: *Didn't arise*

5.9 Natural calamity: Problem due to natural calamity was arisen from

5.12 Project aid disbursement and re-imbursement: *Not Applicable.*

5.13 Mission of the development partners. *Not Applicable.*

5.14 Time & Cost Over-run: As mentioned in B-01 & B-02.

5.15 Project Supervision/Inspection: *Not arisen.*

5.16 Delay in Decision: Change in project planning & design during 1st RDPP.

5.17 Transport: *Not Applicable.*

5.18 Training: *Not Applicable.*

5.19 Approval: *Didn't arise*

flood and siltation in the offtake area.

5.10 Project financing, allocation and Release: Had to arrange huge sum of money in short time for land acquisition payment abiding all financial regulations. So multiple ADP/RADP appropriations were required.

5.11 Design formulation/approval: *Didn't arise.*

5.20 Others.: *None*

6. Remarks & Recommendations of the Project Director:

Dhaka, the capital city of Bangladesh, has been established on the bank of the Buriganga river. After years of unplanned urbanization & industrialization within & suburb the city, water quality of the Buriganga river had deteriorated severely due to insufficient water flow, silted-up river bed, direct disposal of solid & human waste to the river, contaminated affluent from the tanneries & industries etc. Also, illegal occupancy along the river course had encroached the river at various locations. Though in monsoon, there is adequate water in the river to halt water quality deterioration, but in dry season, water quality gets worse & produces bad smell in river due to low flow of water. So, pollution of the Buriganga river & deteriorating water quality of the river has been a burning issue. BWDB, within their organizational mandate, formulated the project to increase dry season flow in the river & thus improve the water quality during that period.

To ensure sufficient dry season flow in the Buriganga river, the planning was to divert some portion of the Jamuna river's flow through New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River system. The length of the river system up to start Turag-Buriganga confluence is 162.50 kilometers. Under this project, the whole length was scheduled for dredging/re-excavation & thereafter required further maintenance. The main objective of the project to reduce the pollution in the Buriganga river by increasing the flow at the off take of the river (at the D/S of Jamuna Bridge) at the New Dhaleswari river. For this reason, 245 m^3/Sec of water will enter in the off take of the river system at Kalihati, Tangail. After flowing the water through the New Dhaleswari-Pungli-Bangshi-Turag River system, the flow of the Buriganga River will be increased by 141 m^3/Sec.

The project is taken up based on a study carried out by IWM in 2004. Upon Honorable Prime Minister, Peoples Republic of Bangladesh's special interest & directives of Honorable Hight Court, BWDB has taken up the project in 2009 & it was approved by ECNEC in April, 2010. After approved of the project, few setbacks were observed during implementation. The major setbacks being quick siltation in the intake water route and other being possibility of endangering foundation of existing bridges in the augmented route. To find a solution both mathematical & physical modelling were run during implementation as well as some piloting re-excavation works. After analyzing the findings by national experts, some changes in project planning & design were bought in. To accommodate that 1st RDPP was approved in June, 2016 with the project period lasting June, 2020. Later the project was extended for 2 more years with another revision for re-arranging financial provision of land acquisition & guide bundh expenditures.

During implementation of the project, maximum transparency is ensured. Measurement & quality of all the executed works are ensured through Taskforce committee of BWDB. Besides, high officials of the Ministry, IMED and BWDB visited throughout the implementation of the project & provided their insights into project implementation. National experts have paid their opinion while revising the project planning during 1st RDPP. The project was implemented as per their valuable guidance.

After implementation of the project, the flow has increased notably in dry season. Though in some portions of Gazipur & Dhaka district, dredging couldn't be done as planned due to illegal occupancies & some local problems. Post work measurement of executed dredging & re-excavation works were jointly taken with the Taskforce committee after few months of execution. Upon this time, siltation on the river system has reduced the amount of executed works. So, there is a huge saving in dredging works. Also planned management of dredged material through this project has contributed to 120-acre land reclamation in Kalihati upazila of Tangail district.

The river system carries huge amount of silt. To resist the silt intrusion in the river system, a silt trap has been constructed near the New Dhaleswari off take at Kalihati, Tangail. The silt is being deposited naturally at sediment basin in the rainy season. The deposited silt must be kept under maintenance dredging every year just after rainy season between October to December. So that water can enter and flow in the river system in the dry period (December to May) without any obstruction. BWDB is planning to deploy own dredgers to conduct maintenance dredging at the offtake & sediment basin every year. It will be very tough to accommodate dredging work within BWDB's regular O&M budget. So, more financing from O&M budget is highly required to ensure sustainability of the project. It is also observed that, new industries are being built on the riverside which is contributing to extensive pollutions in the river system in addition to existing industries. So proper monitoring should be ensured by DoE & other competent authorities to control untreated effluent disposal directly in the river to achieve optimum benefit of the project.

Date: 17.10.2022

Signature and seal of the Project Director
(Md. Abdul Matin Sarkar)
Chief Engineer
Central Zone, BWDB
Dhaka.

7. Remarks/Comments of Agency Head

The main objective of the project is to the improvement of water quality through the enhancement of dry season flow in the Buriganga & Turag River system by increasing the flow at the off-take of the river (at the D/S of Jamuna Bridge) at the New Dhaleswari river. The project is taken up based on a study carried out by IWM. After approval of the project, a few setbacks were observed during implementation. Both mathematical & physical modeling was conducted during implementation as well as some piloting re-excavation works. After analyzing the findings of the study with national experts, some changes in project planning & design were bought in. After the implementation of the project, the flow increased notably during the dry season. Also, the planned management of dredged material through this project has contributed to the 120-acre land reclamation in Kalihati Upazila of Tangail district. The river system carries a huge amount of silt for which a silt trap has been constructed near the New Dhaleswari off-take at Kalihati, Tangail. The silt is deposited naturally in the sediment basin in the rainy season. The deposited silt must be kept under maintenance dredging every year which would be very tough to accommodate within BWDB's regular O&M budget. So, more financing from the O&M budget is highly required to ensure the sustainability of the project.

27/10/2022

Date: .....

Signature and Seal
(FAZLUR RASHID)
Director General
BWDB, Dhaka.

8. Remarks/Comments of the officer in- charge of the Ministry/Division

The main objective of the project is to improve the water quality through enhancement of dry season flow in the Buriganga and Turag River system. Few setbacks were observed during project implementation. Overcoming all this problems, the project achieved 94.89% physical progress at completion. The flow has increased notably in dry season in the river system through New Dhaleswari-Turag-Burigonga. Reclamation of 120 acre land in Kalihati upazilla of Tangail district is also a great achievement of this project. Maintenance dredging works are required every year to sustain the river flow.

Date: .....

Signature and Seal

Annexure- I

Executive summary of the study Conducted by IWM

EXECUTIVE SUMMARY

Introduction

Bangladesh Water Development Board (BWDB) has been implementing the Buriganga River Restoration Project, since April 2010, to augment the flow in the Buriganga by diverting a quantum of water from the Jamuna through the New Dhaleswari-Pungli-Bangshi-Turag-Buriganga river system. The DPP of the project with main item of works - the re-excavation/dredging of 162.5 km river with a control structure at the offtake - was approved by the Government on 06.04.2010 with an estimated cost of BDT 9440.70 million and implementation period from April 2010 to December 2013 (which was later extended up to December 2014 without changing the financial provision).

Institute of Water Modelling (IWM) has been entrusted for detailed offtake management study and monitoring of the hydraulic performance of the improvement works using mathematical modeling tools and physical observations. The study has two components: Component-I is the Mathematical Modelling for Offtake Management of the New Dhaleswari River and Component-II is the Hydraulic Monitoring of New Dhaleswari-Pungli-Bangshi-Turag-Buriganga River System. The Final Report of Component-I was submitted and accepted in May 2013; Draft Final Report of Component-II, covering monitoring of execution of physical works in respect of hydraulic performance and water quality monitoring, was submitted in June 2014. However, inseparable items and findings of Component-I are repeated for completeness of the Report. This is Final Report of Component-II of the study.

Data Collection and Analysis

Relevant hydrometric and hydrographic data, satellite images and other information have been collected from different organizations and sources. In addition, primary data were collected for model calibration. Cross-section survey, carried out by BWDB Hydrology Division @ 100m interval, was used for 1D model. IWM carried out intensive survey operation for 20km reach of the New Dhaleswari, starting from its off-take point, @ 50 meter interval. About 500 transects had been surveyed as the intervals are closer at the bends.

Bankline survey was carried out for a length of 35*2=70 km, covering the whole model domain, by taking GPS positions of the bankline. The survey campaign was completed in the dry season of 2011. But appreciable bankline changes occurred at the offtake and its immediate downstream due to erosion of monsoon 2011. The bankline survey operation was repeated to calibrate the model as precise as possible.

Flow measurements were carried out up till October 2012 at 6 (six) locations along the augmentation route @ 3 (three) times a year (peak/nearly peak discharge of monsoon, falling flood discharge of October/November and minimum flow during March/April). Flow measurements were conducted by using both Acoustic Doppler Current Profiler (ADCP) and Valeport non-directional current meter following ISO 748 manual. Measurements were taken at 3-points (0.2d, 0.6d and 0.8d) at each vertical. Valeport was used in the monsoon when tidal influence was negligible.

Water level data at 4(four) locations along the augmentation route were collected for a period of 22 months for calibrating the models hydro-dynamically and for monitoring purpose. For monitoring purpose it will be repeated for another 10 months. Water level observations are carried out from 6:00AM to 6:00PM at 3 hour interval for non-tidal case and 1 hour interval for tidal case. It will continue for total study period of 3 years.

42 sediment samples were collected from the Jamuna, in front of offtake, and up to 20 km of the New Dhaleswari – Pungli system. Analysis results of both the bed and suspended sediment samples provided scope to calibrate the morphological models with real data.

Necessary secondary data series of 45 water level stations, 11 discharge stations, 34 rainfall stations and 6 evaporation stations were collected and analyzed. Most of the data were available with IWM as those had been collected for different studies including North Central Region Model studies.

Base map of the project area has been developed using the images of different years to find out the shifting of bankline along the augmentation route. Images for the dynamic offtake area have been collected for long 11 years. The images of recent time are of multi-spectral with high resolution. Satellite images were used to understand the changes that occurred with the elapse of time.

Development of Models

In accomplishing the tasks, IWM updated the one-dimensional (1D) hydrodynamic model developed during the feasibility study of the project. The model of feasibility study period was based on North Central Region Model (NCRM). The updating has been accomplished using recent hydro-meteorological data collected from both secondary and primary sources. The latest cross-section data of the year 2011, surveyed by BWDB Hydrology Directorate, were used to replicate the prevailing situation. The model was calibrated with observed water level data of Sirajganj and New Dhaleswari offtake of 2010 monsoon. The calibration result was found satisfactory.

Two two-dimensional (2D) base models were developed under the present study using MIKE21C program to simulate full hydrodynamic and morphological processes of the river system concerned. These base models were developed considering the prevailing hydro-morphological conditions with up to date hydro-morphological data as well as newly surveyed bankline data and cross-section survey data of 2011. One 2D base model was developed exclusively for offtake mouth covering 21km reach of the Jamuna River and 5km reach of the New Dhaleswari River from its off-take point. The other 2D base model covered 35 kilometer of the New Dhaleswari from the offtake structure location. The 2D base models were developed with cross-section and bankline survey carried out in pre-monsoon 2011 by IWM that were later updated after monsoon 2011. During monsoon 2011, appreciable changes occurred within the domain of 2D models including the natural loop cut at Jokerchar in between km 7+450 to km 10+100 for which fresh survey and updating of models were carried out. The 2D model, available at IWM - developed earlier for monitoring of river training works of the Bangabandhu Bridge, was also updated with recent data pertinent to the present study to assess the erosion rate of the Jamuna left bank around the New Dhaleswari offtake.

The developed models were used for prediction of performance/assessment of dredged river and offtake structure.

Prediction of Performance of Design Section of Augmentation Route

In view of the fact that the New Dhaleswari-Pungli-Bangshi-Turag augmentation route cannot be widened as indicated in the feasibility study due to human interventions along the river banks with the elapse of time, alternative design approaches were studied by IWM in consultation with the Project Director and BWDB Design Circle-I. After several trials, design criteria and parameters were finalized that fit with the feasibility study recommendations with respect to water flow and the attainable sections. Performances of the sections, thus obtained by engineering formulae, have been assessed through updated 1D Model to predict the effectiveness during the dry season. The model was simulated with the dry season water level data of 1983-84 hydrological year (which matches with the feasibility study recommended minimum water level of 5.8 mPWD on the Jamuna near the offtake). New design cross-sections have been applied in the model.

The model generated flows at different locations match very closely with the feasibility study recommended dry season inflow of 245 cubic meter per second at the New

Dhaleswari offtake and 141 cubic meter per second at the starting point of the Buriganga. This illustrates that the augmentation route, with newly designed sections, would perform satisfactorily provided re-excavation is done as per design.

As per the verified design sections, the river bed levels vary from +0.74 mPWD at offtake to -4.00 mPWD at the outfall of the Turag and start of the Buriganga. The bed width gradually reduces from 82.50m to 46.00m from the New Dhaleswari to Buriganga River.

Further positive aspect is that the minimum water level of the extreme dry year of 1983-84 has been used in the analysis. The reality is that the occurrence of design minimum water level will be very rare and even if it happens, it will exist for very short period. The minimum flow may, therefore, be maintained throughout the augmentation route if design sections are maintained properly.

Performance of Dredged Channel during Low Flow against High Inverts of Existing Bridges

There exist 20 bridges along the augmentation route. The existing river beds are much higher than the design levels of dredging at the corresponding locations. The depth of cutting at different bridge locations varies from 0.00 meter to 6.59 meter. The available information of the bridges have been collected by BWDB field offices that includes span length, number of spans, bridge width, number of piers, dimension of pier, level of pile cap, width of pile cap, level of existing beds, present bank levels, etc. Design drawings of the bridges could not be made available that was necessary to ascertain the foundation condition. BWDB Design Office made rigorous analysis of the available data. Design office concluded that out of 20 bridges, 14 bridges would allow the design flow at existing condition, while the river beds of remaining six bridges would require deepening from 0.63 meter to 3.59 meter to allow the design flow to pass through those.

IWM reviewed the BWDB analysis of data and found almost the same scenario. IWM further suggested that piers of at least nine bridges would require protective measures; otherwise there will remain risk of failure of the bridges (Ref: Table 6.8). 1D model was simulated putting dimensions of the most critical six bridges. The model results show that the design flow would pass through the bridge sections with the suggested cutting levels of BWDB Design. As a corollary, this would be true for all the bridges.

Assessment of Performance of Offtake Structure in respect of Flood Inundation

Flood inundation along the augmentation route has been assessed both with provision of offtake structure and without offtake structure. The comparison of flooding for both the situations illustrates the performance of the offtake structure. To assess the flood inundation without structure, flow of 1500 m^3/s has been considered, as predicted by the 2D model for 1998 flood with partly silted up offtake; while in case of provision of control structure at the offtake, flow of 830 m^3/s has been considered (as the structure has been designed with this maximum allowable flow).

The model results show that the flooded area is less with the provision of offtake structure (Ref. Table 6.2 and Table 6.3). About 19,648 hectare of agricultural land is likely to become flood free and areas of F_0 and F_1 land, which could be brought under rice cultivation, increase by about 1,140 hectare. The flood depth is likely to decrease by about 1.5 meter in the immediate downstream of the structure.

Assessment of Performance of Offtake Structure in respect of River Bank Erosion

The 2D model simulations, as described under Section 6.2.2, show that the river banks of the New Dhaleswari and the Pungli erode during high floods for both the situations - with structure at the offtake and without any structure at the offtake, although erosion in 'with structure' condition is not that significant.

The erosion predicted with no structure situation indicates that medium to major protective works would be required to protect the important and costly infrastructures along the bank of the New Dhaleswari and the Pungli. There was severe erosion during monsoon 2011 at about 1.8 km downstream from the offtake though there was neither a major flood nor any dredging at the offtake. This indicates that medium to major protection would be required in absence of any control structure at the offtake, even without any dredging.

Assessment of Performance of Offtake Structure in respect of Sedimentation

The 2D model simulated to assess the sedmetation pattern during high floods, with and without offtake structure, shows a clear difference for the two situations (Article 6.2.3). The quantity of sediment that deposits over a long 33km reach beyond the proposed structure location (structure location is at 1.8 km) during the high flood of 1998 was about 25.47 lac cubic meter with no structure at the offtake, and 12.92 lac cubic meter with structure at the offtake. Sedimentation in front of structure location will be around 10.5 lac cubic meter in both the cases. The yearly sediment deposition for average flood has also been estimated. There also remains clear difference with provision of structure and without structure. The predicted quantity of sediment deposition over 33 km reach in the downstream of the structure location is 17.65 lac m^3 with no structure, and 14.74 lac m^3 for structure condition. Sedimentation in front of structure location will be around 6.71 lac m^3.

Assessment of Performance of Offtake Structure in Reducing the Risk of Existing Bridges during High Flood

Dredging of the Augmentation Route will invite huge inflow in the monsoon from the Jamuna. With dynamic condition of bed where it will remain partly silted up, flow of about 1500 m^3/sec will enter in the augmentation route during the high floods. This will create risk of failure of existing bridges. For this, a structure with maximum allowable flow of 830 m^3/sec has been planned at the offtake. But during implementation phase, opposition against the construction of the structure grew up for which in depth model study was carried out for five critical bridges. The model predicts high performance of the offtake structure. As per model prediction, dredging at design section without structure will require major to heavy foundation treatment of all the twenty bridges. Even the Elenga Bridge might require replacement. However, with control structure at the offtake, nine bridges will require moderate to major foundation treatment (Ref. Table 6.8).

Assessment of Effectiveness of Lining of Designed River Section at the Offtake

In the face of growing opposition, various alternatives of the offtake regulator were explored of which suggestion of lined channel, at the offtake including its mouth and immediate downstream reach, to prevent bank and bed erosion in absence of offtake structure received majority support. IWM verified the design sections with 1D Model. It was found that the lined channel functions well for dry season flow condition; it allows the design flow. The dry season flows at different critical locations were estimated through model for unlined condition of the whole system. The same exercise was then repeated considering 1.5 km lined channel and the remaining unlined channel. The flows at different critical locations were found exactly the same as before. The model was simulated for high flood event (1998 flood condition). It was found that the flows at different locations are little more than in the partial lined condition. It was thus concluded that the lining of the channel at the offtake will make the channel stable and check erosion within this reach; however, as it does not reduce the flow during high floods, the adverse effects of additional flow due to dredging are supposed to continue in the downstream; also the maintenance dredging over lined channel comprising CC Blocks would be difficult for which lining of 1.5 km at the offtake cannot be an alternative of the offtake regulator.

Possibilities of Further Positive Impact of Offtake Structure

Hydraulic aspects have been assessed for flow of 1500 m^3/s considering dynamic situation

where river bed remains partly silted up. But if the flood peak happens before the offtake bed is substantially silted up, the flood flow may exceed 1500 m^3/s, which is likely to cause more damages in the downstream.

With control structure at the offtake, the damages have been assessed with 830 m^3/s flow as the structure has been designed with this maximum allowable flow; with controlled operation of the structure gates, it could further be reduced. The feasibility study recommended for a maximum flow of 650 m^3/sec. In such a case, the damages would further be reduced with the operation of control structure.

Monitoring Survey of Cross-sections

Siltation rate over 34.80 km from the offtake mouth along the augmentation route has been predicted and estimated with the help of 2D model, specially developed under the study. Siltation over the remaining length of the augmentation route has been estimated from physical cross-section survey. Surveys at 56 pre-selected locations have been carried out for two consecutive years, 2011and 2012 before and after the monsoons. The estimated quantity of siltation during the monsoon 2011 from Km 33.50 to the outfall of Turag into Buriganga is 25.29 lac cubic meters. Quantity of sedimentation for average year from offtake to km 33.50, as estimated from model, is 21.46 lac cubic meters. It is evident from the cross-section monitoring that major siltation occurs at the offtake. It was further noticed that local scour occurs at different locations throughout augmentation route.

Water Quality Monitoring

The Turag-Buriganga-Dhaleswari River system is experiencing huge pollution due to growth of population and industry on the banks of these rivers. River water quality falls rapidly after receiving discharges of industrial effluents and domestic wastes without treatment. The pre-project Dissolved Oxygen (DO) level is less than 1mg/l and it is expected that implementation of the project would bring that up to 4 mg/l. To ascertain the performance of physical works, measurements of water quality at six locations (Ref. Figure 7.2) was undertaken. The pre-project water quality campaign was completed in December 2013. In-situ measurements and laboratory tests of collected water samples at the Environmental Engineering Laboratory of Bangladesh University of Engineering and Technology (BUET) were carried out. DO levels in the Buriganga were found to be below 1 mg/l (Ref. Table 7.5). Post-project measurement campaign would be carried out after completion of planned physical works.

Concluding Remarks

Scheduled completion time for performance monitoring study ended in mid-January 2014. IWM completed all hydraulic measurements, field surveys and development of models and model predictions of performance of planned works, and submitted the Draft Final Report of Component-II of the study in June 2014. But, the overall progress of physical works of the Project was much behind the schedule for various reasons. The approximate expenditure till March 2014 was Tk.8,400.00 lac and overall physical progress was little more than 10%. Both the physical and financial progresses are insignificant with respect to the targeted completion time and financial provision as per the original DPP. The original completion time of the Project was December 2013.

This is obvious that without having satisfactory progress of physical works, especially arranging augmented flow through the New Dhaleswari Offtake during the dry season, the post-implementation monitoring and modelling works could not be accomplished by IWM, and IWM waited for more than one year to wrap up the study. As such, in a meeting (held on 4 June 2015) with the Additional Director General (Planning), BWDB as the Chair, the Draft Final Report of Component-II of the study was accepted on condition that the reasons for partial results of monitoring to be spelled out clearly in the Final Report.

Annexure- II

Executive summary of the study Conducted by RRI

Executive Summary

1 Introduction

The Buriganga is the main river flowing beside Dhaka, capital city of Bangladesh. Over the last several decades the flow of Buriganga, Turag, Shitalakkha and Balu River has been reduced drastically. As a consequence, the water quality of the river Buriganga has been severely deteriorated due to insufficient river flow, solid waste, tannery and disposal of contaminant effluent from different types of industries. In addition, continual growth of population and changes of the socio-economic perspective have severely encroached the once famous inland navigation route of Dhaka and Narayanganj. In view of the above circumstances, Bangladesh Water Development Board (BWDB) undertook a project entitled "Buriganga River Restoration Project (BRRP)" with a view to ensure sufficient dry season flow in the river Buriganga by diverting flow from the Jamuna river. Institute of Water Modelling (IWM) carried out a full scale feasibility and mathematical model study (2008) from which it was revealed that in order to augment 141cumec dry season flow in the Buriganga river, 245cumec of the Jamuna flow has to be diverted through the New Dhaleshwari river. It was also understood that without sustainable management of the New Dhaleshwari off-take it would not be possible to augment flow in the Buriganga river during dry the season due to large scale sedimentation at the off-take and in the distributary river bed. In order to ensure diversion of 245cumec of Jamuna flow structural interventions at the off-take in the form of guide bunds, sediment basin and dredging would be needed. Sediments that enter into the New Dhaleshwari river from the Jamuna should be allowed to settle at a specified location to facilitate maintenance dredging and to let more or less sediment-free water to enter into the river system. The planning and design of appropriate structural measures at off-take need decision support by the physical model investigation. Under the above circumstances, an agreement has been signed between BWDB and RRI on 13th June, 2017 to carry out the physical model investigation for sustainability of Buriganga River Restoration Project.

2 Objectives

The overall objective of physical model studies is to augment 141 cumec dry season flow in the Buriganga river by diverting 245 cumec water from the Jamuna river through the New Dhaleswari-Pungli-Bangshi-Turag-Buriganga river system. The model would confirm the adequacy of hydraulic design of sedimentation basin and revetment. It would fix up the proper alignment and optimize the dimension of sedimentation basin as well as the location of revetment at the intake canal.

The specific objectives of the distorted overall morphological model are:

- Verifying 141 cumec dry season flow of the Buriganga river by diverting 245 cumec water from the Jamuna river;
- Qualitative assessment of sedimentation and flow distribution at the intake;
- Optimization of location and alignment of sediment basin;
- Performance of sediment basin;
- Morphological assessment at and around the intake qualitatively and
- Getting overall idea and sustainability about the system

3 Data and Model

The study area (**Figure A**) is situated just downstream of the Bangabandhu Bridge and consists of 5km reach (part width) of the Jamuna river and 10km reach (full width) of the New Dhaleshwari river including the off-take. In order to construct the physical model, the primary data include bathymetry and bank line covering the whole study reach, D_{50} of bed and bank materials, water level gradient, point velocities, sediment load and discharges at selected cross-sections both in the Jamuna river as well as in the Dhaleshwari river. Bathymetric survey has been conducted in the selected reach of the Jamuna and the New Dhaleshwari. Discharge has been measured at 3(three) cross-sections (1 in the New Dhaleshwari and 2 in the Jamuna). These measurements have mainly been used for calibration of the model. Therefore, an attempt has been made to measure discharge of the Jamuna River when it is more or less at dominant flow stage. Bathymetric data was collected according to the requirement of the physical model investigation. GPS survey has been conducted to record the boundary position of the intake canal. The collected secondary data include historical discharges and water levels of the Jamuna recorded at different gauge stations of BWDB. Design drawings of guide bunds, intake canal and sedimentation basin have been supplied by BWDB. Positions of the guide bunds, intake canal and sedimentation basin have also been supplied by BWDB in map form and as numerical data.

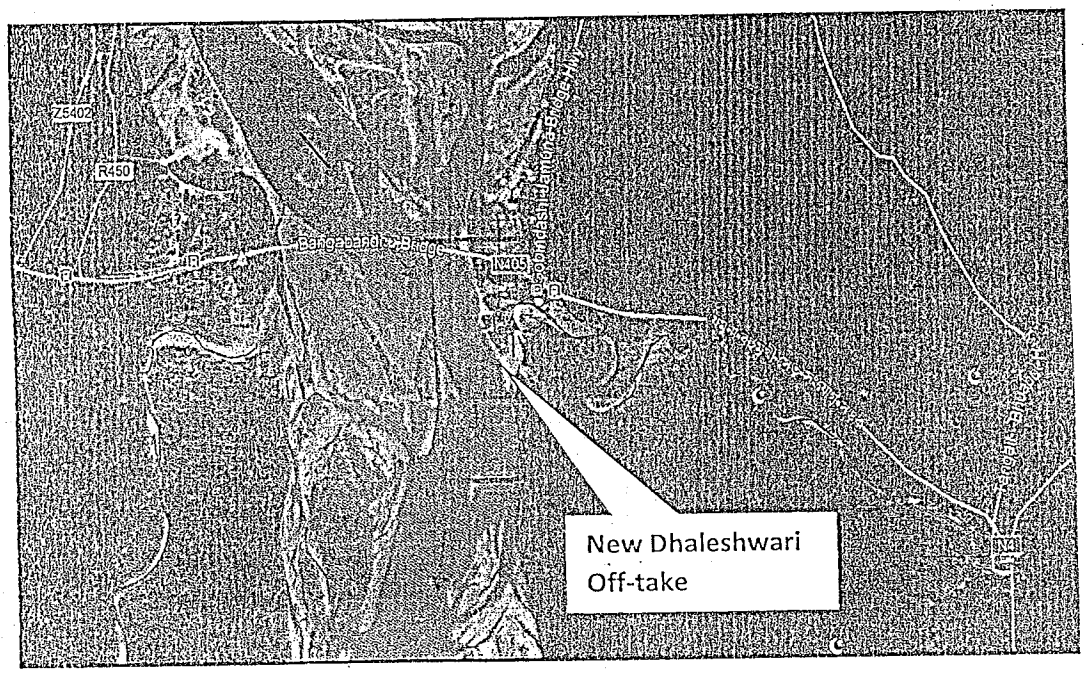

Figure A: The location of the study area

The model is constructed in an open air model bed and the bed materials consist of fine sand. The layout of the model was given with the reference grid points in the model. Channel planform has been reproduced using these grid points and the bed and bank levels have been fixed up by levelling instrument as per bathymetry using rise and fall method. It was a movable bed model and hydraulic similarity was established in the model with a distorted scale. The scale ratio was selected as 1:50 for vertical scale and 1:200 for horizontal scale for model construction. The model has been designed to fulfil both the flow and sediment transport criteria simultaneously. In this physical model, various types of instrument and facilities are needed such as, a sharp-crested weir for measuring flow, point gauge for measuring water level, 3-D current meter for measuring velocity, high resolution camera for taking video and photographic view of model, stopwatch for taking instant time and floats for identifying flow path of flowing water.
The initial bathymetry of the model is reproduced based on the field survey data collected under the framework of this study. The model is calibrated on the basis of prototype water levels, flow velocities and sediment transport data. Manual sediment feeding is done with a view to assess the required rate of sediment feeding during the model run. Continuous monitoring of the model bed is done by taking

soundings of the model bed. In a movable bed model scale conditions related to the three governing processes namely water flow, sediment transport and changes in bed topography have to be fulfilled simultaneously in order to obtain complete similitude between the model and prototype. During the design of the model, this aspect has been taken into account with due care. Some deviation from the Froude and sediment transport conditions has to be accepted during the model design in order to fulfil the both conditions simultaneously. It has led to scale effects to some extent. Therefore, such scale effects have been assessed for providing informed interpretation of the model results. After design and construction the model is calibrated with dominant discharge of the Jamuna river. Since part width of the Jamuna river has been reproduced in the model the corresponding prototype discharge is 21,172 m^3/s. The measurements during the calibration include water levels, bed levels, point velocities, float tracks and discharges. The scales of the different basic and derived parameters have been determined based on the calibration test results. **Table A** presents scale factors of some key parameters.

Table A: Key characteristics parameters and scale factors obtained after calibration of the model

Parameters	Unit	Prototype	Model	Scale factor
Basic Parameters				
Discharge (Q)	m^3/s	21172.14	0.39886	53082
Width (W)	m	814	4.07	200
Depth (D)	m	15.3	0.28	54.64
Velocity (V)	m/s	1.7	0.35	4.86
Slope (i)	-	0.00007	0.001	0.07
D_{50}	m	0.00018	0.0001	1.8
Sediment transport (s)	m^2/s	0.00330	0.000034	97
Derived Parameters				
Chezy (C)	$m^{1/2}/s$	52	21	2.48
Froude Number (F_r)	-	0.14	0.21	0.67
Fall Velocity (w)	m/s	0.022	0.009	2.44
Shields parameter (Θ)	-	3.61	1.70	2.12
Non-dimensional particle parameter (D_*)	-	4.55	2.53	1.8
Weigh function of influence of bed slope ($f\Theta$)	-	0.5674	1.0837	0.52
Flow adaptation length (λ_w)	m	2104	6.24	337.0
Adaptation length for sediment transport (λ_s)	m	2493	6.50	384
Critical velocity for motion (Vcrm)	m/s	0.37	0.28	1.32
Critical velocity for suspension (Vcrs)	m/s	0.44	0.27	1.63
1D morphological time scale	days	42.93	0.2542	168.90

4 Application Tests and Results

During the model study seven application tests (T1-T7) with different test conditions have been conducted in addition to calibration test (T0). The first test (T1) is conducted in base condition whereas in remaining tests the proposed off-take interventions (guide bund, intake canal, sediment basin and exit canal) have been in place. In test T2, test T3 and test T4 dredging only within the intervention location has been considered. On the other hand, in test T5, test T6 and test T7 dredging within and beyond the intervention location has been taken into account. The aim of the considered test conditions is to investigate the river response to different interventions with and without launching apron in place in terms of flow distribution into the New Dhaleshwari River as percentage of corresponding Jamuna river discharge, sedimentation within and beyond the intervention location and depth, location and extent of scour whole etc. Based on the results of these test, Draft Final Report and Final Report of the model study have been submitted. A meeting on the Final Report was held at Pani Bhaban, Dhaka on 11-11-2020. The meeting came up with a set of decisions regarding some additional information that are needed from the model study. In order to furnish the needed additional information, River Research Institute has to conduct a few tests by remoulding the model bed. Previous bathymetric data have been used for remoulding the model bed. During all these tests a dredged bed condition (within and beyond the intervention location) has been considered as initial bathymetry. The lowest bed level of the dredged channel is considered at 0.00mpWD. The model results are briefly described hereafter. The detailed model results have been furnished in the main report.

4.1. Discharge and Velocity

The application tests are conducted for dominant discharge of the Jamuna river. Besides, application tests have also been conducted for Jamuna discharges of 30000m^3/s, 20000m^3/s, 4000m^3/s, 3000m^3/s and 2000m^3/s. One of the main objectives of the application tests is to investigate the discharge distribution into the New Dhaleshwari as a percentage of monsoon, post monsoon and dry period flow of the Jamuna and also the flow pattern and velocity field within the intervention location and beyond. The results of base run (test T1) have been used to assess the effects of structural interventions at the off-take and proposed dredging.

It is observed from the test T1 that about 0.85% of Jamuna discharge (44000m^3/s) enters into the New Dhaleshwari river which is very close the measured value for the for the same Jamuna discharge. Velocity distribution in the transverse direction at different locations downstream of the off-take point is shown in Figure B. On the other hand, with proposed structural interventions in place and dredging only within the intervention location cause a two-fold increase in the New Dhaleshwari river corresponding to the same Jamuna discharge. This increased New Dhaleshwari discharge and corresponding velocity beyond the intervention location are found to be not enough to cause a sufficient lowering in the river bed level beyond the intervention location to allow the targeted dry season flow (245m^3/s) to enter into the New Dhaleshwari river. It is, therefore, clear that dredging should be conducted not only within the intervention location but also in the whole river system to achieve the target. In order to investigate for this, the river stretch in the model beyond the intervention location has been dredged to a minimum level of 0.00mPWD. With this test condition flow distribution into the New Dhaleshwari as a percentage of Jamuna river is found to have increased substantially at the beginning for all discharges of the Jamuna river. However, with the passage of time this percentage of flow distribution has been continued to decrease until a more or less dynamic equilibrium state is reached. For dominant discharge of the Jamuna river, 4.3% of the same entered into the New Dhaleshwari river initially. However, after four years (no dredging during this period) this percentage value is found to have decreased to 3.6%. The reduction in discharge distribution into the New Dhalesahwari after one year (deposited bed) compared to the initial condition corresponding to different Jamuna river discharges appears in Table B.

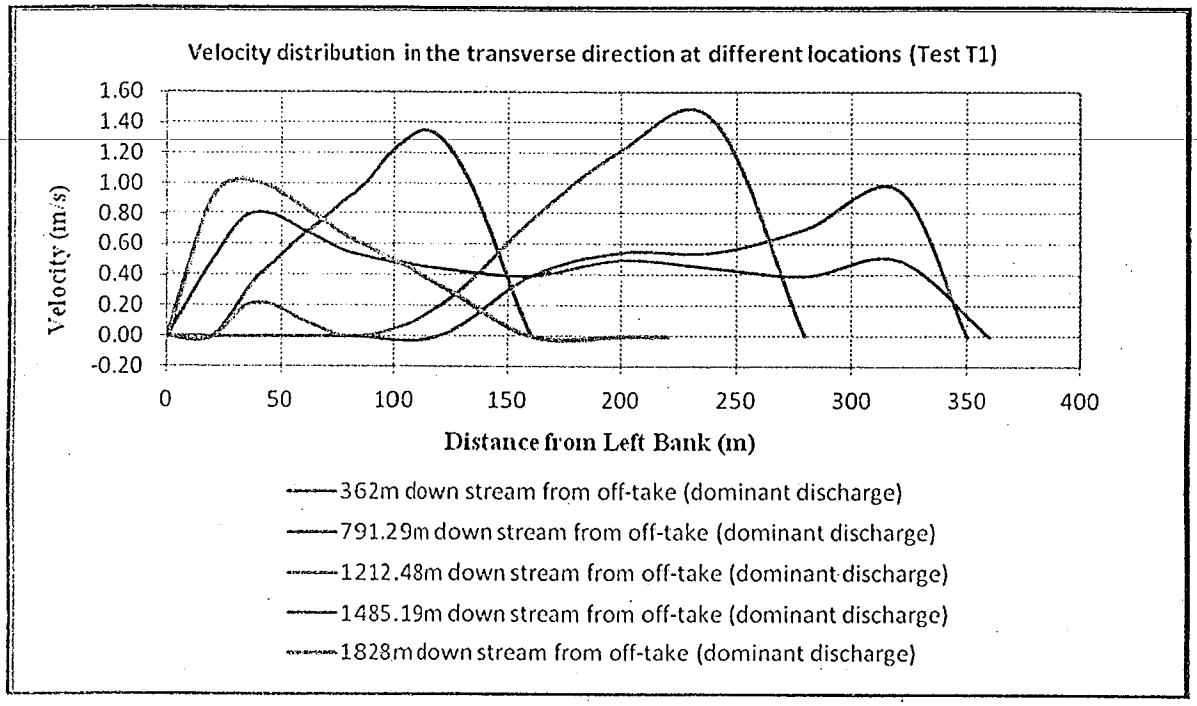

Figure B: Velocity distribution along the cross-sections at different locations downstream of off-take point in base condition

Table B: Average flow velocity at the entrance, within and at the exit of the sediment basin at different times and in different discharge conditions

Jamuna river discharge (m^3/s)	Discharge into the New Dhaleshwari river as percentage (%) of Jamuna river discharge	
	In the beginning (on dredged bed)	After one year (on deposited bed)
44000	4.30	3.88
30000	4.80	4.20
20000	5.90	5.10
3000*	15.95	8.93
2000*	20.55	12.25

* Same water level of 6.08mPWD is maintained at the off-take for $2000m^3/s$ and $3000m^3/s$ Jamuna discharges

The water level at the New Dhaleshwari off-take corresponding to the discharges of $44000m^3/s$, $30000m^3/s$ and $20000m^3/s$ are 10.9mPWD, 9.45mPWD and 8.10mPWD respectively. The lowest recorded water level at the off-take corresponding to Jamuna discharge of $2850m^3/s$ is 5.80mPWD, whereas design water level at the same location for dry season discharge is 6.08mPWD. The targeted dry season flow in the New Dhaleshwari river is a function of the dry season discharge of the nearby Jamuna channel with which the off-take remains connected and also of the corresponding water level at the off-take. If no maintenance dredging is carried out, the dry season flow in the New Dhaleshwari

river will continue to decrease with time. This fact is revealed from the information presented in **Table C**. It is clear from **Table C** that if no maintenance dredging is carried out after the first year of dredging there remains uncertainty in obtaining targeted dry season flow (245m^3/s).

Table C: Likely dry season discharge through the New Dhaleshwari river initially (no deposition on the dredged bed) and after one year (with deposited sediments on the dredged bed) for two different water levels at the off-take

Q_{Jamuna} (m^3/s)	Initial $Q_{Dhaleshwari}$ (m^3/s)		After One Year $Q_{Dhaleshwari}$ (m^3/s)	
	WL = 5.80 mPWD	WL= 6.08 mPWD	WL = 5.80 mPWD	WL= 6.08 mPWD
2000	355	411	208	245
3000	430	479	228	268

The average flow velocity at the entrance, in the middle and at the exit of the sediment basin in the beginning and at the end of one year corresponding to different Jamuna river discharges appears in **Table D**.

Table D: Average flow velocity at the entrance, within and at the exit of the sediment basin at different times and in different discharge conditions

Jamuna river discharge (m^3/s)	Average velocity at the entrance of sediment basin (m/s)		Average velocity within the sediment basin (m/s)		Average velocity at the exit of sediment basin (m/s)	
	In the beginning	After one year	In the beginning	After one year	In the beginning	After one year
44000	1.45	1.50	0.67	0.85	1.48	1.41
30000	1.27	1.39	0.64	0.91	1.28	1.29
20000	1.14	1.32	0.62	0.93	1.17	1.21
3000*	0.90	0.60	0.44	0.47	0.92	0.55
2000*	0.77	0.55	0.38	0.42	0.78	0.52

* Same water level of 6.08mPWD is maintained at the off-take for 2000m^3/s and 3000m^3/s Jamuna discharges

If no maintenance dredging is carried out, the magnitude of flow velocity as well as the velocity distribution in the transverse direction at different locations of the intake canal and sediment basin is likely to change with the passage of time in response to morphological changes within the intervention location. For dominant discharge the velocity distribution in the transverse direction at different locations of the intake canal and sediment basin after four years appears in **Figure C**. On the other hand, the likely flow pattern (flow line) within the intervention location for the same is shown in **Figure D**.

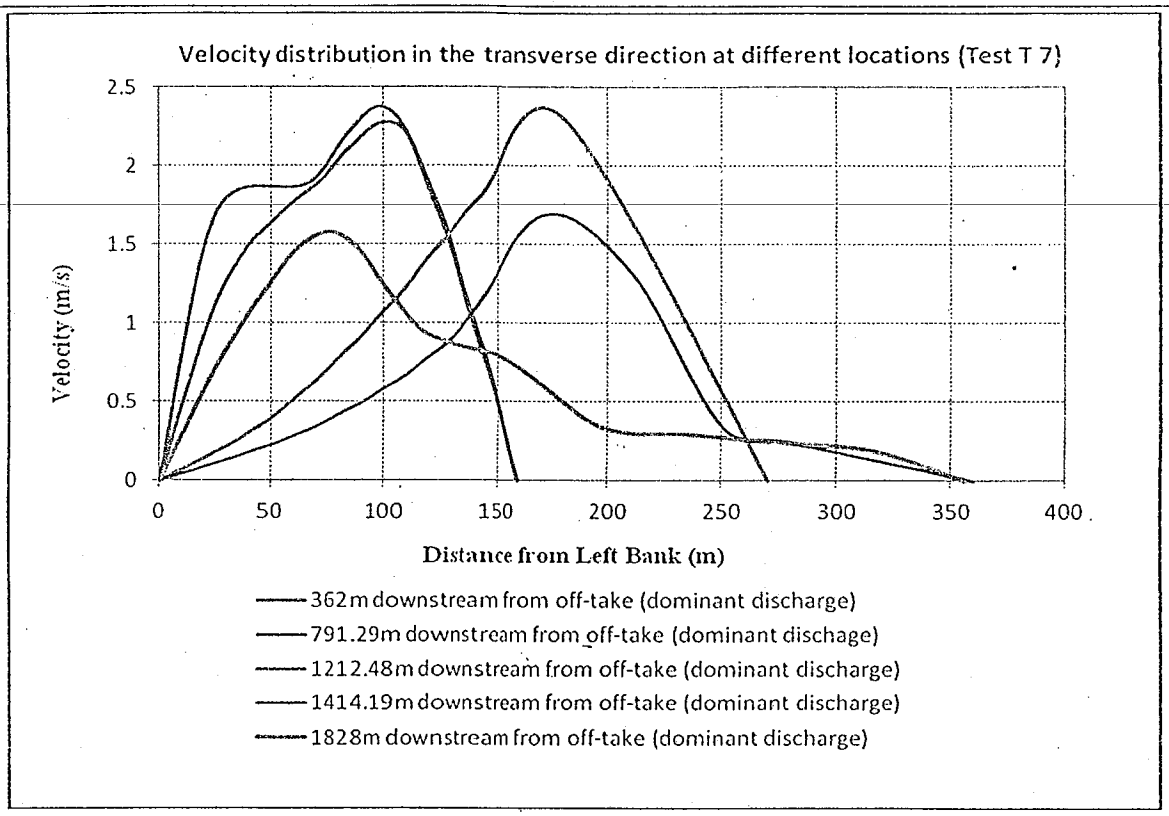

Figure C: Velocity distribution in the transverse direction at different locations of the intake canal and sediment basin after four years

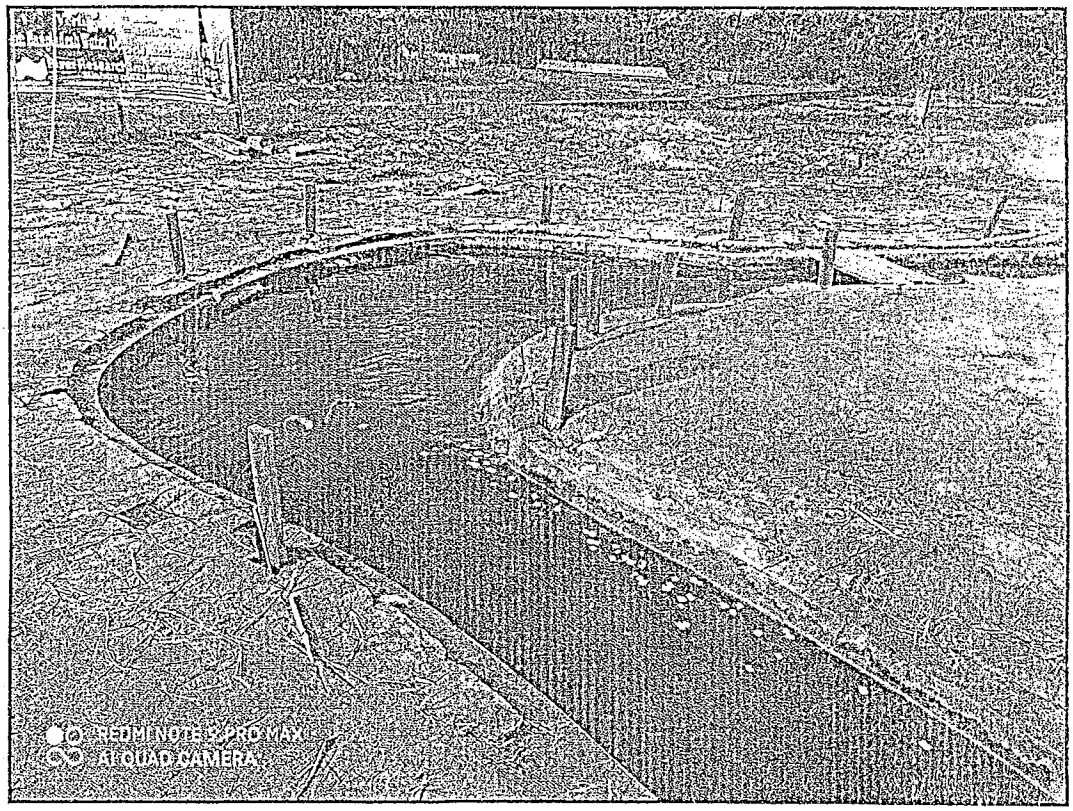

Figure D: Flow pattern within the intervention location for dominant discharge

4.2 Sediment Deposition

The sedimentation within the intervention location has been assessed in line with the ToR. Th assessment is qualitative to some extent due to presence of scale effects in the model in reproduction o sediment transport. For 80 hours of model run the total volume of sediment deposited within th intervention location is found to be 36 ft^3which is equal to 2228941m^3 in the prototype. An analysi shows that 33% of this sediment volume will be deposited within the intake canal, 59% within th sediment basin and 8% within the exit canal. For a similar development to occur in the prototype about 4 to 5 years may be needed. Assuming a period of 4 years the average annual volume of sedimen deposition within the intervention location is 557235m^3. Of this volume about 183887m^3 of sediment i likely to be deposited within the intake canal, 328769m^3 within the sediment basin and 44579m^3 withi the exit canal. In the intake canal, the deep channel is likely to occur along the right bank. If no dredgin is done the average thickness of sediment in the intake canal and within the sediment basin could b 3.84m and 4.13m respectively. The thickness of deposited sediment in the intervention location varie along and across the space. In the intake canal the thickness is much higher than the average value alon the left side of the canal. On the other hand, in the sediment basin the thickness is much higher than th average value along the right side of the sediment basin.

After one year, the net sedimentation within the intervention location is found to be 653242m^3 which i somewhat higher than four-year average value. Due to development of a large scour hole along the righ side at the off-take, the net sedimentation within the intake canal is found to be less than the four-yea average value after the first year. On the other hand, within the sediment basin the same is higher than th four-year average value after the first year. Of the 653242m^3 sediment within the intervention locatio after the first year, 16% is deposited in the intake canal, 76% in the sediment basin and 8% in the exi canal. It is, therefore, clear that most of the sedimentation may occur within the sediment basin in the firs year. If no dredging is done after one year, the rate of sedimentation is likely to increase in the intak canal and decrease in the sediment basin during the second year compared to that during the first year. A reduction in the discharge into the New Dhaleshwari river corresponding to all discharges of the Jamun river is likely to occur with the progress of sedimentation within the intervention location.

In the first year, the net sedimentation in the intake canal is found to have increased gradually fror upstream to downstream. Starting from the entrance of the sediment basin towards upstream, 57% of th net sedimentation in the intake canal is found to have occurred within a stretch of 411m. From 411m t 755m and from 755m to 1011m the same is 25% and 18% respectively. Therefore, the average thicknes of net sedimentation varies (increases) in the intake canal from upstream to downstream. Again startin from the entrance of the sediment basin towards upstream, the average thickness of sedimentation for stretch of 411m is approximately 0.88m and from 411m to 755m and from 755m to 1011m the same i approximately 0.64m and 0.28m respectively.

Within the sediment basin, the average thickness of net sedimentation is found to be approximatel 1.57m after the first year. A channel conveying most of the water that enters into the sediment basin ha been noticeable. The deposition areas within the sediment basin in the first year appear in **Figure E**.

discharge compared to the base condition. It is found from the model investigation that much fl concentration will occur at all bend locations of the river. It is likely to be the case for all other rivers the system. As a result, outer banks of these rivers will tend to migrate. At present, the New Dhaleshw river is highly meandering (sinuosity greater than 2) in the immediate downstream of the off-take ove river stretch of about 11km. Therefrom, the sinuosity of the river is found to have decreased towards t downstream although the river still maintains strong meandering pattern. It is, therefore, anticipated tl unprotected banks (outer bank) will come under erosion attack after implementation of the project due increased discharge and flow velocity. In the model over 10km length of the New Dhaleshwari river h been reproduced. Based on the model results, the likely locations within the study reach that m experience bank erosion are shown in **Figure F** and **Table E**. Chainage starts from the off-take mou (784765.00mE, 2698516.00mN).

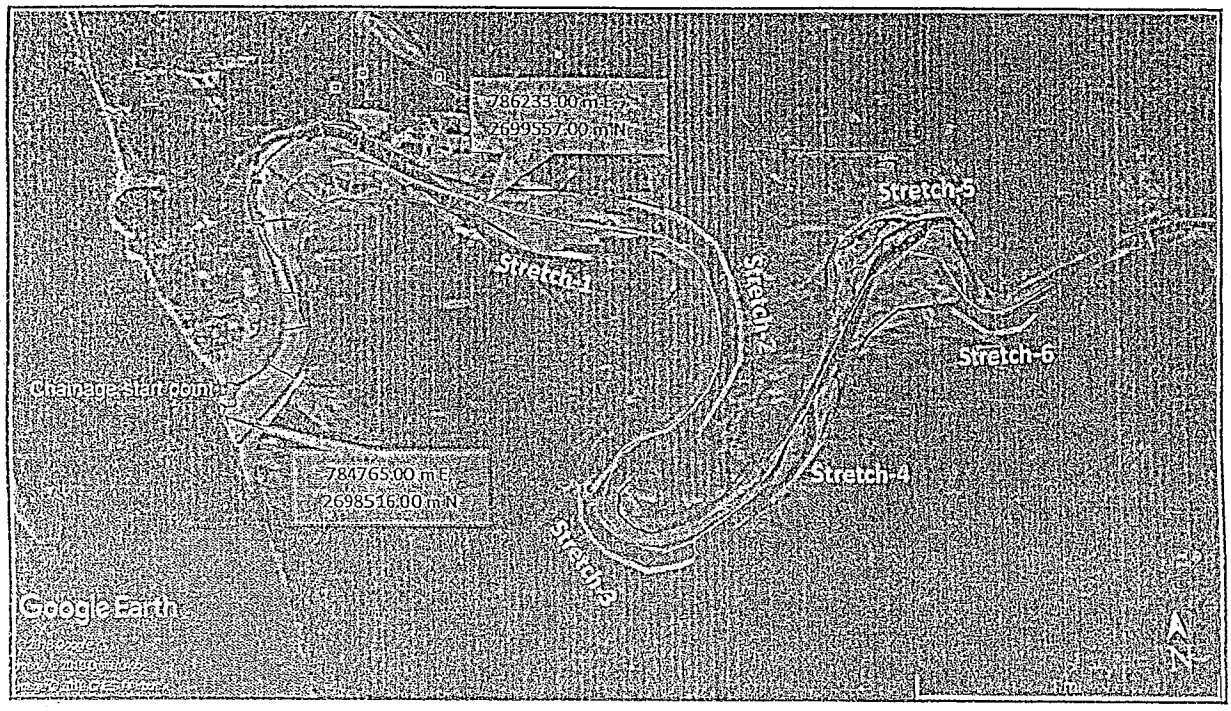

Figure F: Location of erosion prone stretches within the study reach

Table E: Location of erosion prone stretches within the study reach

Description	Chainage from the off-take mouth (Km)	Comment
Sttretch-1	2.9 to 3.3	Right bank
Stretch-2	3.5 to 4.7	Left bank
Stretch-3	5.3 to 6.1	Right bank
Sttretch-4	6.4 to 6.9	Right bank
Stretch-5	7.7 to 8.4	Left bank
Stretch-6	8.3 to 8.7	Right bank

4.4 Maintenance Dredging Locations

After implementation of the project sedimentation will occur in the intake canal, sediment basin and e: canal. Sedimentation will also occur beyond the intervention location. The filling process will be rath complex and will proceed from upstream to downstream direction. Initially most of the sedimentation w

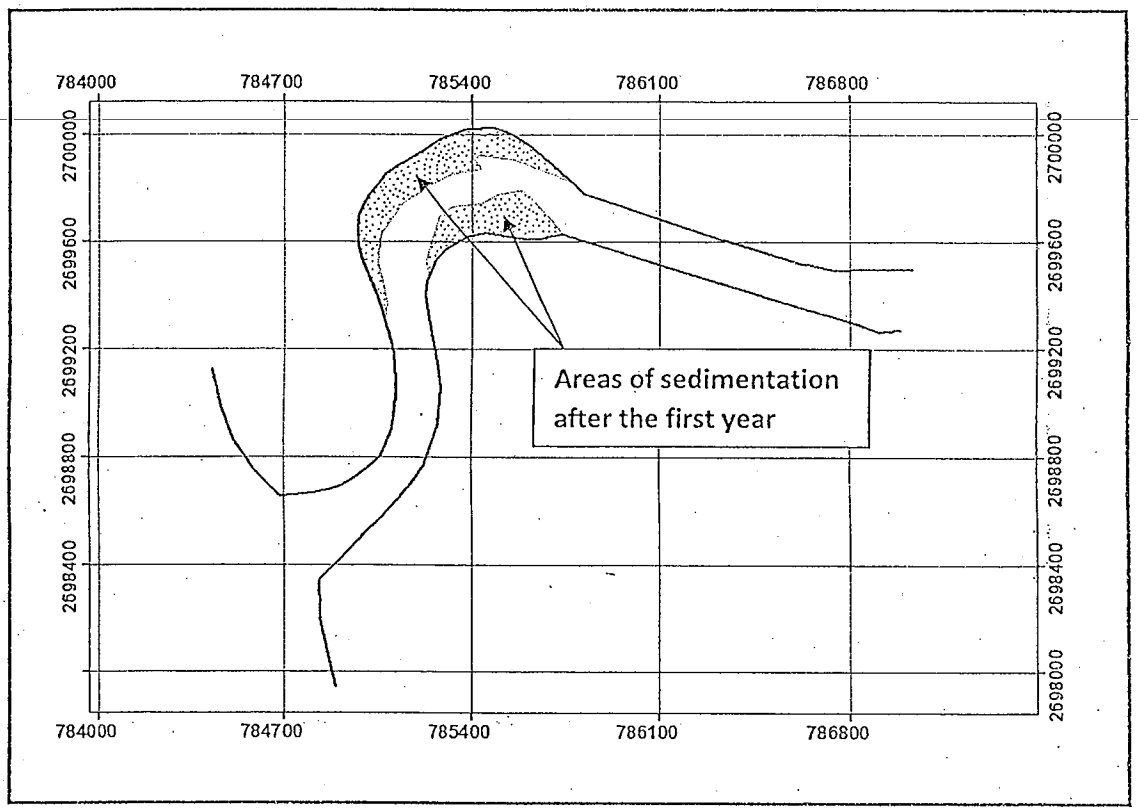

Figure E: Areas of sediment deposition within the sediment basin in the first year

The model covers a stretch of 10km of the New Dhaleshwari river. In the downstream of the intervention location (just downstream of the exit canal), the bank position over a stretch of 449m is kept fixed during the model tests and beyond that the banks are movable. The model is capable of simulating bank erosion qualitatively. The volume of sediment deposited in this 449m river stretch is found to be about 40957m^3 after the first year. Beyond this stretch downstream, the bank position of the dredged channel is shifted by different amounts at different locations due to bank erosion/accretion resulting in the change of cross-sectional geometry of the dredged channel. Bed erosion and deposition are also noticeable. It is not possible to furnish a value as to what amount of sediments that enter into the New Dhaleshwari river has been deposited there. However, comparison between the initial cross-sectional area (dredged channel) and that after the first year with respect to a monsoon flood level shows not much difference. Also initial minimum bed level (0.0mPWD) does not vary much after the first year. It is, therefore, clear that the net sedimentation and average thickness of the same in the dredged channel beyond the intervention location might be less after the first year. The model results indicate that the sedimentation is likely to throughout the entire study reach (10km) and beyond. Since the model deals with 10km stretch of the New Dhaleshwari river it is not possible to indicate the exact stretch of the river in which sedimentation will take place. It is found from the model investigation that the rate of sedimentation beyond the intervention location decreases towards the downstream. Sedimentation beyond the intervention location will continue to occur irrespective of whether dredging in the intervention location is done or not. However, annual dredging in the intervention location in general and in the sediment basin in particular is likely to reduce the rate of sedimentation beyond the intervention location compared to that for "no dredging" situation.

4.3 River Bank Erosion

After implementation of the project, the average cross-sectional flow velocity as well as maximum flow velocity at every cross-section of the New Dhaleshwari river would be increased due to increased

ccur at the off-take along the left bank of the New Dhaleshwari river and in the intake canal immediately lownstream of the off-take and a deep scour hole would be formed near the right bank of the off-take. .he river will try to achieve its more or less previous state and pattern and filling up of the dredged hannel accordingly. Due to sedimentation, the average bed level of the intake canal will go up. However, or the proposed alignment of the intake canal more sedimentation will occur along the left bank as the iver will try to maintain a deeper channel along the right bank. As a result, net sedimentation in the ntake canal would be less compared to that within the sediment basins in the first year. On the other and, the flow and sediment deposition pattern in the sediment basin will undergo complex changes with ime and with the progress of filling up process of the intake canal. As in the intake canal the average bed evel in the sediment basin will go up compared to the dredged bed condition. The general trend of ediment deposition is found to be more deposition along the right side of the basin. The average bed evel of the exit canal will also go up with not much difference in height across the canal. Therefore, naintenance dredging within the intervention location should be planned according to the above stated act. It is expected that if maintenance dredging within the intervention location is conducted properly the illing up of the dredged channel beyond the intervention will be rather slow provided that bank erosion roducts are not allowed to enter into the river flow by taking appropriate erosion protection measures. It vould be appropriate to carry out maintenance dredging within the sediment basin (**Figure E**) and at its nmediately upstream and downstream every year to make sure the availability of targeted dry season low in the New Dhaleshwari river. Moreover, it would be wise to monitor the developments and conduct ross-section survey for deciding about maintenance dredging needs elsewhere. It is expected that if local ediments (from bank erosion and from floodplain during extreme flood event) can't enter into the river naintenance dredging every year may not be needed elsewhere in the river system.

5 Conclusions and Recommendations

5.1 Conclusions

The following conclusions have been drawn from the physical model study:

- There exists, sedimentation problem at the New Dhaleshwari off-take. The mean bed level as well as the minimum bed level at the mouth of the river is much higher than the dry season water level of the parent river (Jamuna). As a result, no flow situation occurs during dry season in the New Dhaleshwari river;
- The rivers surrounding the Dhaka city receive flow from the Jamuna river through New Dhaleshwari river. Due to adverse morphological developments at the off-take of the New Dhaleshwari river and large scale sedimentation in the river bed downstream of the off-take these rivers virtually get no flow from the Jamuna for a considerable period of a year;
- In order to restore the polluted Buriganga river, a flow of 141 m^3/s has to be added to bring up the dissolved oxygen level to a tolerable limit. It could be done by augmenting 245 m^3/s of flow from the Jamuna river through new Dhaleshwari river;
- In order to augment the targeted flow from the Jamuna river a sustainable solution of the sedimentation problem at the off-take and in the river channel downstream of the same is essential;
- The New Dhaleshwari river originates from the Jamuna river at about 3km downstream of the Bangabandhu bridge. It was a small channel prior to the construction of the Bangabandhu bridge. During construction of the bridge the mouth of the Old Dhaleshwari river was closed and as a result, the mouth of the New Dhaleshwari river opened up. Since then the river has undergone large scale morphological changes. Analysis of recent field data indicates that the off-take of this river is still unstable and the river is yet to attain its dynamic equilibrium state;

- The proposed interventions at the off-take in the form of guide bunds, intake channel, sedimentation basin and exit channel could be a solution of the existing problem if properly planned and implemented with provision for long-term monitoring and maintenance dredging;
- Model results suggest that targeted flow augmentation of the New Dhaleshwari river is possible with the proposed interventions at the off-take and dredging as per design. However, river channel downstream of the interventions has also to be dredged to a level of 0mPWD with sufficient width for smooth passage of dry season flow. The extent of such dredging should be determined based on field data as in the model study only 10km stretch of the New Dhaleshwari river has been reproduced;
- Implementation of the proposed structural interventions with dredging only within the interventions as per design will increase the flood discharge through the New Dhaleshwari river. Discharge of the New Dhaleshwari river corresponding to the dominant discharge of the Jamuna river will be more than two times higher compared to that in base condition. However, this increased discharge is not sufficient enough to lower the bed level of the downstream channel to a level that allows for the smooth conveyance of targeted dry season flow;
- The dredged channel will tend to get filled up gradually. It is unlikely that the sedimentation will occur only within the sediment basin as thought before. In fact, sedimentation will occur throughout the dredged channel including sediment basin at the intervention locations. Several sand waves will move from upstream to downstream during the filling up process. It may take about 4 to 5 years for the river to reach its dynamic equilibrium state by filling the dredged channel if no maintenance dredging is carried out.\
- Dredging within and beyond the intervention area will cause a fourfold increase in the New Dhaleshwari discharge corresponding to the dominant discharge of the Jamuna river compared to base condition. However, in the beginning this increase in discharge is found to be five-fold higher than that in base condition. If no dredging is done it would continue to decrease with time until a more or less dynamic equilibrium state is reached;
- Within the sedimentation basin, a sand bar would tend to form along the right side bund and the deep channel would tend to shift towards the left side;
- In the intake channel the deep channel will remain along the right bank;
- There is potential for forming deep scour hole at the off-take mouth on the right side, at the starting point of the sedimentation basin on the right side and at the end point of the sedimentation basin on the left side. These locations should be protected well against local scour and developments there should be monitored closely;
- Total volume of sediment deposited at the intervention locations (intake channel, sedimentation basin and downstream channel is estimated to be 36 ft^3 in the model which is equivalent to 2228941 m^3 in the prototype. It has taken about 80 hours of model run to attain this state. The 2D morphological time scale of this model is estimated to be 113. It means it would take several years (4 to 5 years) in the prototype for similar development to occur;
- Of the total volume of deposited sediment within the intervention location within four years, 59% will get deposited in the sediment basin. On the other hand, the percentage of deposited sediment in the intake and exit canals will be 33% and 8% respectively. If no dredging is done the average thickness of sedimentation in the intake canal and sediment basin will be 3.84m and 4.13m respectively;
- In the first year, the volume of net sedimentation in the intervention location may be 653242m^3 of which 16% may be deposited in the intake canal, 76% in the sediment basin and 8% in the exit

canal. The average thickness of sedimentation after the first year varies spatially. In the sediment basin, the average thickness of sedimentation could be 1.57m;

- If no dredging is done in any year particularly in the sediment basin and at the immediate upstream and downstream of the same there may arise uncertainty in having targeted dry season flow of 245m^3/s to some extent;
- The model covers 10km stretch of the New Dhaleshwari starting from the off-take. Therefore, it is not possible to furnish any indication as to what may happen elsewhere in the whole river system in terms of sedimentation. It appears from the model results that the rate of sedimentation may decrease towards the downstream from the exit point of sediment basin. However, the unprotected banks in the downstream of the intervention location may experience erosion/accretion. Also there may occur bed erosion at different locations. The cross-sectional shape of the dredged channel may undergo changes. However, the cross-sectional area may not change much after the first year compared to the initial condition (just after dredging).
- Proposed structural interventions at the off-take and dredging within and beyond the structural interventions will ensure targeted dry season flow through the New Dhaleshwari river;
- The planning for annual maintenance dredging should be made based on monitoring survey data. Monitoring of developments may be made in the light of depositional trend as stated in Section 5.3 of this report ;
- Due to increased flood discharge and consequent increased flow velocity bank erosion potential may increase in the entire river system particularly at the bend locations. In order to cope with this situation outer bank of the eroding bends may be stabilized by undertaking appropriate bank protection measures; and
- There is a sharp bend in the immediate downstream of the intervention location. The cut-off ratio of this bend is very high. An imminent natural cut-off is not unlikely under increased flood discharge condition. After the occurrence of an artificial or natural cut-off a river takes quite some time for self-adjustment against such a development/intervention. It may result in increased bank erosion in the downstream of the cut-off; and
- Since the results of this model investigation are indicative, it would be wise to use the given information in combination with results from numerical model studies and detail model studies (if any) to assist in developing the final design for the structural interventions.

5.2 Recommendations

The following recommendations have been made as to the proposed structural interventions and dredging at the New Dhaleshwari off-take to augment dry season flow for the restoration of the Buriganga river.

- The findings from this model investigation may be used in combination with results from numerical model studies and detail model studies (if any) in developing the final design for the structural interventions and dredging. Since the New Dhaleshwari off-take and river morphology undergo constant changes it is recommended to consider the most recent morphological conditions during the planning and design of the proposed interventions;
- Dredging upto the recommended level (0.00mPWD) downstream of the interventions should be considered. The stretch of the river over which dredging to be carried out should be determined based on the most recent field data;
- The need for annual maintenance dredging should be determined based on monitoring survey data analysis and monitoring may be conducted in the light of the depositional trend as revealed

from this study. The volume of sediment (653242m^3) that may get deposited in the intervention location during the first year as revealed from this model study should be considered indicative;

- Dredging every year in the sediment basin and at its immediately upstream and downstream may be considered to make sure availability of targeted dry season flow of 245m^3/s.
- The implications of dredging on flooding potential, bank erosion potential and safety of the existing structures in the river system should be taken into account and appropriate measures should be taken where and when necessary to reduce potential damages to an acceptable limit;
- The proposed structural interventions should be implemented as per plan and design;
- A technically sound dredging strategy and phase wise implementation plan may be devised; and
- Use of physical modeling tool for technical assistance during implementation and monitoring phase of the project may be considered.